LOCAL WORK GROUP REPORT FOR THE NATIONAL ASSESSMENT, INVENTORY, AND MONITORING STRATEGY

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EXECUTIVE SUMMARY

The Local Workgroup surveyed 36 field offices to better understand BLM's field level resource data collection and analysis activities. We also compiled a significant amount of contextual information about these activities including statutory requirements, manual guidance and technical references, budget expenditures and performance reporting, results of previous audits and evaluations, etc.

Major findings include:

- We collect a significant amount of data every year.
- Most of this data is collected resource program by resource program. This makes it difficult for us to leverage data collection activities across programs. It also makes it difficult to prepare interdisciplinary assessments of condition.
- Most of this data is collected in conjunction with specific use authorizations and site specific projects. This makes it difficult for us to assess and report on condition at any broader scale.
- Most of this data is recorded on paper. This both increases the cost of our data collection activities and decreases the utility of the data collected.
- Most of this data is not stored in shared, corporate data bases. This makes it very difficult to use the data in more than one program area or to use data more than once.
- Most of this data is not synthesized and shared with our partners, adjacent landowners or the general public.
- There are significant external sources of data about resource conditions on the public lands. A corporate strategy for the acquisition of this data may reduce overall costs to the bureau.
- Some employees appear to be uncertain about several of our inventory and monitoring responsibilities. Additionally, some offices do not appear to be following through with some monitoring related commitments.

None of these findings are particularly surprising as the Bureau's data collection activities have evolved over time in response to changing user needs for specific resources, new program specific statutory and judicial mandates, and new scientific understandings. The Bureau's data collection and analyses activities were not designed to answer many of the performance and landscape level questions we are currently asking.

These finding, however, do identify significant opportunities to enhance the effectiveness and efficiency of our data collection and analysis activities. At a minimum, we recommend that BLM take the following actions over the next two years:

- Clarify selected statutory and regulatory requirements and the appropriate authority for each of the Bureau's assessment, inventory and monitoring activities.
    - ➢ Clarify how BLM is meeting its statutory inventory obligations under the Federal Land Policy and Management Act.

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    - Clarify BLM's assessment, inventory and monitoring responsibilities with respect to fish and wildlife species, air and water quality, NLCS values, NEPA cumulative effects and best-available information, and the Data Quality Act.

    - Clarify BLM's assessment, inventory and monitoring responsibilities resulting from NEPA decision documents and Biological Opinions and identify specific strategies for meeting those responsibilities.

- Establish overall direction and management responsibility for the BLM's assessment, inventory and monitoring activities.

    - Update BLM's existing assessment, inventory and monitoring manual (MS 1734) to establish more specific, cross-program guidelines for managing resource data collection, storage, analysis, and reporting.

    - Review existing budgeting and performance reporting requirements for BLM's assessment, inventory and monitoring activities.

    - Review existing assessment, inventory and monitoring related training courses and identify unmet needs.

    - Expand availability of assessment, inventory and monitoring information on the web.

- Integrate BLM's assessment, inventory and monitoring activities with the development, implementation and evaluation of land use plans.

    - Update BLM's existing planning manual and handbook (MS 1601) to establish guidelines for interdisciplinary resource condition assessments, interdisciplinary landscape condition goals and objectives, and interdisciplinary strategies for monitoring and reporting on land use plan effectiveness.

    - Develop templates and compile examples of interdisciplinary Management Situation Analyses, interdisciplinary landscape condition goals and objectives, RMP monitoring plans, and RMP evaluations.

    - Provide 1610 funding for the development of RMP implementation strategies and reporting on plan implementation effectiveness, including monitoring activities at the land use plan level.

- Acquire and manage resource information as a corporate asset.

    - Complete architecture/blueprint for BLM's vegetation-related resource data collection and analysis activities.

    - Identify and prioritize data sets for standardizing data collection, storage, and reporting.

    - Develop a pilot and proof of concept for the collection of resource data in the field with a geo-referenced PDA or hard laptop, web-enabled data libraries, and reporting capabilities utilizing the data libraries.

    - Develop a strategy for the conversion and entry of legacy data into data libraries.

    - Develop corporate strategy for acquisition, interpretation and management of external data.

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FINDINGS AND RECOMMENDATIONS

SECTION I: INTRODUCTION

This National Strategy is a multi-year initiative to improve the efficiency and effectiveness of the Bureau of Land Management's (Bureau's) inventory, assessment, and monitoring efforts. Recent requests by the U.S. Congress and the Office of Management and Budget to better and more easily understand the condition of our Nation's public lands and improve the way the Bureau of Land Management (BLM) determines these conditions are significant drivers of this strategic initiative.

This report presents an introduction and the findings and recommendations of the Local Monitoring Workgroup. This workgroup, which was initiated in January 2005 as part of the Bureau's overall National Monitoring Strategy, consists of Field, State, and Washington Office experts (Briefing Tab).

Purpose

The purpose of the Local Monitoring Workgroup, hereafter referred to as the Workgroup, was to: 1) evaluate existing monitoring activities and needs at the Field Office level; and 2) develop recommendations to enhance the Bureau's integration of these activities across programs and across offices. A two-year effort was undertaken by the Workgroup to collect and analyze background information concerning the Bureau's monitoring activities and survey current field monitoring operations. Generally, the Workgroup has focused on the collection and analysis of information concerning the occurrence, condition, and trend of natural resources. Subsequent phases of the National Monitoring strategy will focus on heritage resources and resource use.

Approach

Development of Hypotheses

Initially, the Workgroup identified three overarching hypotheses to be explored through the evaluation effort:

1. There is **insufficient coordination among resource programs** with respect to their natural resource data collection and assessment activities.
2. There are significant **inconsistencies across Field Offices** with respect to their natural resource data collections and assessment activities.
3. There are **significant inefficiencies in the Bureau's natural resource data collection and assessments activities,** especially with respect to data collections, data storage, and data retrieval and sharing.

Development of a Monitoring Process Model and Critical Management Questions

The Workgroup initially scoped the resource data and analysis needs by developing a monitoring process model and evaluation questions. The model (Process Model Tab) offers a graphical picture of typical local office management actions, called triggers, and related monitoring/evaluation steps in a typical monitoring scenario. The model was developed by reviewing existing Bureau enterprise architecture, detailing programmatic processes (e.g., grazing, planning, energy), and identifying similarities. The Workgroup used the model to develop management questions for the field office survey described in the next section. Management questions that emerged from this process are:

- What data are we collecting regarding natural resource conditions, and with what frequency (i.e., who collects what data)?
- Why are we collecting those data?

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- How are data collected?
- How are data stored and analyzed (i.e., in particular, does analysis of the data lead to management recommendations and does it help the BLM understand conditions and trends)?
- Does subsequent data analysis help us determine our effectiveness, and thereby help focus our investments?

Field Office Survey

The Monitoring Practices Survey, (Survey Questions Tab), hereafter referred to as the Survey, was developed for sampling field offices to assess monitoring activities and perceptions. The Survey was developed using a contractor (Coray Gurnitz Consulting) and a subgroup of the overall Workgroup. Based on the questions stated previously in "Development of Hypotheses" and defining monitoring as any activity related to assessment, inventory, or monitoring, a pilot Survey was developed and tested in Roswell, New Mexico, Winnemucca, Nevada, and Glasgow, Montana, field offices. The Survey was refined and discussed with various members of the Washington Office program staffs. The Survey characteristics included a web-enabled operation and 820 variables from 40 questions. A sample of 36 offices was selected using statistically based design methods and the following criteria: geomorphic area, proximity to more populated areas, and dominate land use. The Survey was administered to these offices during the period of June 22, 2006, to August 28, 2006. We received responses from 277 employees with 161 employees reporting that they are directly involved with one or more monitoring activities. The Survey results were evaluated against the Monitoring Process Model and the initial management questions, but the responses were robust enough to provide additional insight on field monitoring practices. The Survey results are available in the Survey Results Tab.

Context of Background Information and Salient Observations

Supporting documentation was gathered to develop a sense of context and to provide historical information relating to assessment, inventory, and monitoring activities within the BLM. This documentation has been assembled in the form of extensive appendices including a review of: Chronology of BLM Events; History of Data Management Efforts; Other Agency Monitoring Strategies; Expenditures and Program Elements; Common Terms; Methods used for Data Collection; Manual Sections; Statutes; General Accounting Office and Other Reviews; Internal Reviews; Program Assessment Rating Tool Evaluations; Legacy Reports; Opportunities identified by the Legacy Team and Training opportunities. Also included are the recent Briefing for the Field Committee; the Process Model; Management Questions; the report from the Business Process Re-engineering team; the web-based Monitoring Practices Survey questions; and the Analysis of the Monitoring Practices Survey. These appendices provide an understanding of past inventory, monitoring, and assessment initiatives; bureau policies; and a review of the Bureau's performance in this area.

Observations

- The BLM and its predecessor agencies, the Department of the Treasury, the General Land Office and the Grazing Service, have been collecting information about resource occurrence, condition and use of the public lands since 1785 (Chronology Tab).
- The Bureau's data collection activities have evolved significantly over this 200-year period. Generally, these changes have been driven by evolving program-specific user needs, new program-specific statutory and judicial mandates, and new scientific understanding (Chronology Tab).
- The Bureau's data collection activities have been driven by the needs associated with specific use authorizations and site specific projects. While the BLM generally has better organized information about use than about resource occurrence or condition, the Bureau's data collection

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activities were not designed to help the Bureau systematically report on occurrence, condition or use of the public lands at the field office, regional or national scale (Survey Results Tab).

- Over the last 10 to 15 years, there has been a move toward more interdisciplinary and broader scale approaches to data collection and analysis. Examples include the Bureau's Land Health Assessments and participation in the Sustainable Development Roundtables. These approaches are encouraging but still need to be further integrated into the Bureau's work processes (Legacy Report Tab).
- Past data collection efforts initiated by the BLM have not been sustained. These include monitoring models and electronic processes such as, Soil Vegetation Inventory Methods (SVIM), Soil Survey Ecological Site Descriptions (ESD), Automated Lands and Minerals Records System (ALMRS), Inventory Data System (IDS), Monitoring Information Data Analyses System (MIDAS), Palm Pilot, and SOZA Architecture. There are various reasons these efforts were not sustained. Some include commitment, funding, national and/or state oversight, independence of programs, and administrative changes (Past Data Efforts Tab and Legacy Reports Tab).
- Many other agencies and non-governmental organizations are wrestling with the same monitoring issues as BLM, including all of the Federal natural resource agencies. OMB, CEQ, GAO and National Academies are very interested in seeing the United States develop a set of national environmental accounts similar to the national economic accounts (Other Strategies Tab; GAO and Other Evaluations Tab; and PART Reviews Tab).
- Generally speaking, the Bureau's assessment, inventory, and monitoring activities are not managed as a unified program; rather, they are an amalgamation of program activities managed under different parts of the BLM organization (Guidance Tab).
- Data collection is usually programmatically driven, does not address storage and retrieval needs, often lacks data standards, generally has inconsistent quality control above the local office, and is not integrated with other programmatic needs (MIS Information Tab and Survey Results Tab).

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SECTION II: FINDINGS AND RECOMMENDATIONS

1.0 CLARIFY SELECTED STATUTORY REQUIREMENTS

1.1 Background

As outlined in Statutes Tab, the BLM has multiple statutory requirements for collecting and reporting on natural and cultural resource data. The following ten statutes have probably been the most significant drivers of data collection and analysis within the BLM. The history begins in 1934 with statutes that authorize survey and investigation of livestock range and wildlife habitat. In the 1960s and 1970s the statutes become more inclusive of all natural resource values.

- **Taylor Grazing Act of 1934:** 43 U.S.C. § 315 *et seq.*

  This Act was the first Federal effort to regulate grazing on Federal public lands. It establishes grazing districts and uses a permitting system to manage livestock grazing in the districts. 43 U.S.C. § 315. The Act provides for the classification of lands for particular uses. 43 U.S.C. § 315f. Additionally, the Act authorizes the Secretary to continue the study of erosion and flood control and to perform such work as may be necessary amply to protect and rehabilitate the areas subject to the provisions of the Act. 43 U.S.C. § 315a.

- **Fish and Wildlife Coordination Act of 1934, as amended** 16 U.S.C. § 661 et seq.

  This Act authorizes surveys and investigation of the wildlife on public domain lands and waters of interest therein acquired or controlled by any agency of the United States. This Act authorizes surveys and investigations of the wildlife on public domain lands including lands and waters of interest therein acquired or controlled by any agency of the United States.

  16 U.S.C. § 661 states that the "Secretary of the Interior is authorized (1) to provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations in the development, protection, rearing, and stocking of all species of wildlife, resources thereof, and their habitat, in controlling losses of the same from disease or other causes, in minimizing damages from overabundant species, in providing public shooting and fishing areas, including easements across public lands for access thereto, and in carrying out other measures necessary to effectuate the purposes of said sections; (2) to make surveys and investigations of the wildlife of the public domain, including lands and waters or interests therein acquired or controlled by any agency of the United States; and (3) to accept donations of land and contributions of funds in furtherance of the purposes of said sections."

- **National Historic Preservation Act of 1966, as amended** 16 U.S.C. § 470, et seq.

  This Act provides procedures to be followed by Federal land managers in providing protection for archaeological resources located on public lands. The Secretary shall, at least once every 4 years, in consultation with the Council and with State Historic Preservation Officers, review significant threats to properties included in, or eligible for inclusion on, the National Register, in order to: (A) determine the kinds of properties that may be threatened; (B) ascertain the causes of the threats; and (c) develop and submit to the President and Congress recommendations for appropriate action 16 U.S.C. § 470a(a)(8).

  Section 106 directs Federal agencies to take into account effects of their actions ("undertakings") on properties in or eligible for the National Register 16 U.S.C.A. § 470f.

  Section 110(a) sets inventory, nomination, protection, and preservation responsibilities for Federally-owned cultural properties 16 U.S.C. § 470h-2(a)(2).

- **National Environmental Policy Act (NEPA) of 1969, as amended** 42 U.S.C. § 4321 et seq.

  Under this act, Congress requires that all Federal agencies include a detailed environmental impact statement (EIS) in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. 42 U.S.C. §

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4332(C). An EIS must include an examination of the environmental impacts of the proposed action, any unavoidable adverse environmental effects and alternatives available to the proposed action. 42 U.S.C. § 4332(C)(i), (ii), (iii). Agencies must examine and include the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. 42 U.S.C. § 4332(C)(iv), (v). Prior to preparing an EIS, the agency must consult with other Federal agencies having expertise on any environmental impact involved. 42 U.S.C. § 4332(C). BLM compliance with this Act necessitates monitoring in order to demonstrate environmental effects. Executive Order Number 11991 declares that, consonant with Title I of the National Environmental Policy Act of 1969, the heads of Federal agencies shall "(a) Monitor, evaluate, and control on a continuing basis their agencies' activities so as to protect and enhance the quality of the environment. Such activities shall include those directed to controlling pollution and enhancing the environment and those designed to accomplish other program objectives which may affect the quality of the environment." Executive Order Number 11,991, 42 FR 26967 (May 24, 1977).

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- **Clean Air Act of 1970, as amended** 42 U.S.C. § 7401 et seq.

  The Federal Air Pollution Control Act, commonly known as the Clean Air Act (CAA), creates a partnership between Federal and State regulatory bodies to address air pollution issues on both a National and local level.

  Part C of the Act, 42 U.S.C. §§ 7470-7492, specifies requirements of the prevention of significant deterioration program (PSD), which protects areas of the United States that have air quality that exceeds the National Ambient Air Quality Standards. Additionally, visibility standards are required for national parks and other areas where visibility is found to be of special value. This Part of the CAA sets out standards that must be taken into account before new pollution sources can be approved.

  The CAA further requires permits for all major industrial sources subject to State administration and Federal oversight in 42 U.S.C. §§ 7661-7661f and establishes a program for controlling substances that contribute to depletion of stratospheric ozone, 42 U.S.C. §§ 7671-7671g.

- **Clean Water Act of 1972, as amended** 33 U.S.C. § 1251 *et seq.*

  This Act is aimed at restoring and maintaining the Nation's waters at a quality for fish, wildlife and recreational use. Administered by the EPA with authorities typically delegated to States and tribes it requires authorities to periodically assess their surface and groundwater water resources, designate beneficial uses for those waters, develop and enforce standards to protect those uses, and promote point and non-point source pollution management programs to sustain those uses in public trust.

  Section 301 (33 U.S.C. § 1311) prohibits the discharge of any pollutant except those made in compliance with the terms of the Act. It imposes multi-tiered effluent limitations on existing sources the stringency and timing of which depends on the nature of the pollutant discharged and the body of water into which it is discharged.

  Section 302 (33 U.S.C. § 1312) authorizes the imposition of more stringent effluent limitations when necessary to improve or maintain water quality.

  Section 304 (33 U.S.C. § 1314) requires EPA to adopt water quality criteria and guidelines for effluent limitations and supervision of the NPDES program.

  Section 305 (33 U.S.C. § 1315) mandates State governments to assess all surface and groundwater monitoring data from within the state on a biennial basis. This monitoring oriented assessments will be done relative to the established water quality standards, it should identify impaired waters, and trigger remedial actions.

  Section 319 (33 U.S.C. § 1329) requires States and tribes to identify waters that cannot meet water quality standards due to non-point sources and the activities that are creating the problem.

The section then instructs States to prepare management plans for the waters that will identify controls and programs for the effluent sources.

- **Endangered Species Act of 1973** 16 U.S.C. § 1531 et seq.

  Section 7(a)(1) (16 U.S.C. § 1536) requires Federal agencies to carry our programs to conserve threatened and endangered species.

  Section 7(a)(2) (16 U.S.C. § 1536) directs all Federal agencies to ensure that any action authorized, funded or carried out by the agency (agency action) is not likely to jeopardize the continued existence of an endangered or threatened species, or result in destruction or adverse modification of a critical habitat of a species. Agencies are required to use the best scientific and commercial data available to fulfill this charge. If, based on the best scientific and commercial data available, the Secretary determines that such species are present; the agency must conduct a biological assessment to identify the species likely to be affected.

  Section 7(c) (16 U.S.C. § 1536) directs each Federal agency to conduct biological assessments for the purpose of identifying any endangered or threatened species.

- **Federal Land Policy Management Act (FLPMA) of 1976, as amended** 43 U.S.C. § 1701 et seq.

  This Act requires that public lands and their resources be periodically and systematically inventoried and that an evaluation of the current natural resource use and values is made of public and adjacent non-public land.

  43 U.S.C. § 1701(a)(8) declares that it is the policy of the United States that ”the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use.”

  43 U.S.C. § 1711(a) requires the Secretary of the Interior "prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values (including, but not limited to, outdoor recreation and scenic values), giving priority to areas of critical environmental concern. This inventory shall be kept current so as to reflect changes in conditions and to identify new and emerging resource and other values. The preparation and maintenance of such inventory or the identification of such areas shall not, of itself, change or prevent change of the management or use of public lands.”

  43 U.S.C. § 1732(a) directs the Secretary of the Interior to “take any action necessary to prevent unnecessary or undue degradation of the lands.”

- **Public Rangelands Improvement Act of 1978** 43 U.S.C. § 1901 et seq.

  This Act establishes a National policy and commitment to improve the conditions on public rangelands, requires a national inventory and consistent Federal management policies, and provides funds for range improvement projects. 43 U.S.C. § 1901(b). It also amends the Wild Free-Roaming Horses and Burros Act and the Federal Land Policy and Management Act of 1976, both of which are summarized in this section. 43 U.S.C. § 1901(a)(6); 43 U.S.C. § 1903(a). BLM compliance with this Act necessitates monitoring in order to share information and demonstrate rangeland improvements. The Act states that "the Secretary of the Interior and the Secretary of Agriculture shall update, develop (where necessary), and maintain on a continuing basis an inventory of range conditions and record of trends of range conditions on the public rangelands, and shall categorize or identify such lands on the basis of the range conditions and trends thereof as they deem appropriate. Such inventories shall be conducted and maintained by the Secretary as part of the inventory process required by Section 201 (a) of the Federal Land Policy and Management Act, and by the Secretary of Agriculture in accordance with section 1603 of title 16; shall be kept current on a regular basis so as to reflect changes in range conditions; and shall be available to the public." 43 U.S.C. § 1903(a).

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The above list is not all inclusive. Resources such as wilderness, soil, wild and scenic rivers, and wild horses and burros gained specific legislation in the 1960s and 1970s. More recent statutes govern across disciplines such as the Government Results and Performance Act of 1993 and the Data Quality Act of 2001. Information on these Acts is presented in Statutes Tab.

1.2 Findings

1.2.1 The inventory mandate in section 1711 of FLPMA is increasingly a source of legal challenge. The Solicitor's Office has recommended the BLM develop guidance addressing this mandate.

1.2.2 Employees do not appear to have a clear understanding of the Bureau's inventory, assessment, and monitoring responsibilities in the following areas: fish and wildlife species; air and water quality; recognized values in National Conservation Areas and National Monuments; cumulative effects and best-available information in NEPA; and data quality.

1.3 Recommendations

1.3.1 Clarify how the BLM is meeting its statutory obligations in section 1711 of FLPMA. Identify organizational responsibilities and potential funding strategies related to these obligations.

1.3.2 Clarify the Bureau's assessment, inventory, and monitoring responsibilities in the following areas: fish and wildlife species; air and water quality; National Conservation Areas and National Monuments values; NEPA cumulative effects and best-available information; and data quality.

Sign-off: 200/300/170 and DD Operations
Lead: WO DAD 200

2.0 CLARIFY SELECTED REGULATORY REQUIREMENTS

2.1 Background

A significant portion of the Bureau's monitoring activities are associated with implementing the decision documents signed in conjunction with environmental assessments, environmental impact statements, or with the Biological Opinions prepared by the Fish and Wildlife Service (FWS) in compliance with Section 7 of the Endangered Species Act.

Section 1505.2 of the Council on Environmental Quality's (CEQ) regulations implementing NEPA states that agencies shall prepare a concise Record of Decision and that this record shall "State whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not adopted. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation." [1505.2(c)]

Section 1505.3 of the regulations states that:

> "Agencies may provide for monitoring to assure that their decisions are carried out and should do so in important cases. Mitigation [Sec. 1505.2(c)] and other conditions established in the environmental impact statement or during its review and committed as part of the decision shall be implemented by the lead agency or other appropriate consenting agency. The lead agency shall:
> a. Include appropriate conditions in grants, permits or other approvals.
> b. Condition funding of actions on mitigation.

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c. Upon request, inform cooperating or commenting agencies on progress in carrying out mitigation measures which they have proposed and which were adopted by the agency making the decision.
d. Upon request, make available to the public the results of relevant monitoring."

Section 7 of the Endangered Species Act directs all Federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the FWS, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to the management of Federal lands as well as other Federal actions that may affect listed species, such as approval of private activities through the issuance of Federal permits, licenses, or other actions.

Through the Section 7 consultation process "reasonable and prudent measures" and implementing "terms and conditions" may be identified to minimize impacts to species or critical habitat. These conditions are included in the Biological Opinions the FWS prepares on proposed Federal actions. These conditions are non-discretionary and must become binding conditions to any grant or permit.

2.2 Findings

2.2.1 The BLM makes commitments to monitor in its NEPA decision documents. The BLM also is required by Biological Opinions and some court orders to monitor. Recent internal and external evaluations suggest that some BLM offices are not meeting these monitoring commitments.

2.2.2 The BLM lacks comprehensive guidance on whether the costs of implementation and effectiveness monitoring may be born by the project proponents.

2.3 Recommendations

2.3.1 Clarify the Bureau's policy regarding requirements for the Bureau and the direct decision maker for monitoring commitments in NEPA driven decision documents and FWS Biological Opinions.

2.3.2 Develop guidance on project proponent funding of implementation and effectiveness monitoring based on existing cost recovery efforts.

Sign-off: 200/300 and DD Operations
Task: WO 200/800/300/170

3.0 REVIEW AND DEVELOP OVERARCHING POLICIES, PROCESSES, AND RESPONSIBILITIES FOR INVENTORIES, ASSESSMENTS, AND MONITORING

3.1 Background

The Survey strongly indicates that most monitoring activities are initiated at the project or permit level, not at the land use plan level. As a consequence, it is difficult for the Bureau to say anything comprehensive about resource occurrence, condition, and trend or the effectiveness of management activities above the permit or project level. This is especially the case if more than one program or field office is involved.

This is not surprising given the number of separate statutes, manual sections, technical references, training courses, budget activities, and program elements related to inventory, assessment, and monitoring work that exist.

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It will take time for the BLM to knit together these disparate data collection and data analysis activities. Four critical first steps that will begin the integration of monitoring activities are: (1) institutionalizing a cross-program understanding of the basic components of an effective monitoring program; (2) developing a cross-program "ecological" model to help identify ecosystem indicators; (3) integrate inventory, assessment, and monitoring-related budget and performance reporting; and (4) providing employees and partners with ready access to existing inventory, assessment, and monitoring guidance, techniques, and training.

The scientific literature on inventory and monitoring outlines a number of steps that are critical to the development of a successful program. A model depicting these steps, Figure 1, was developed early on in the National Monitoring Strategy. These steps include identifying management questions, acquiring data, managing and analyzing data, and taking the appropriate action.

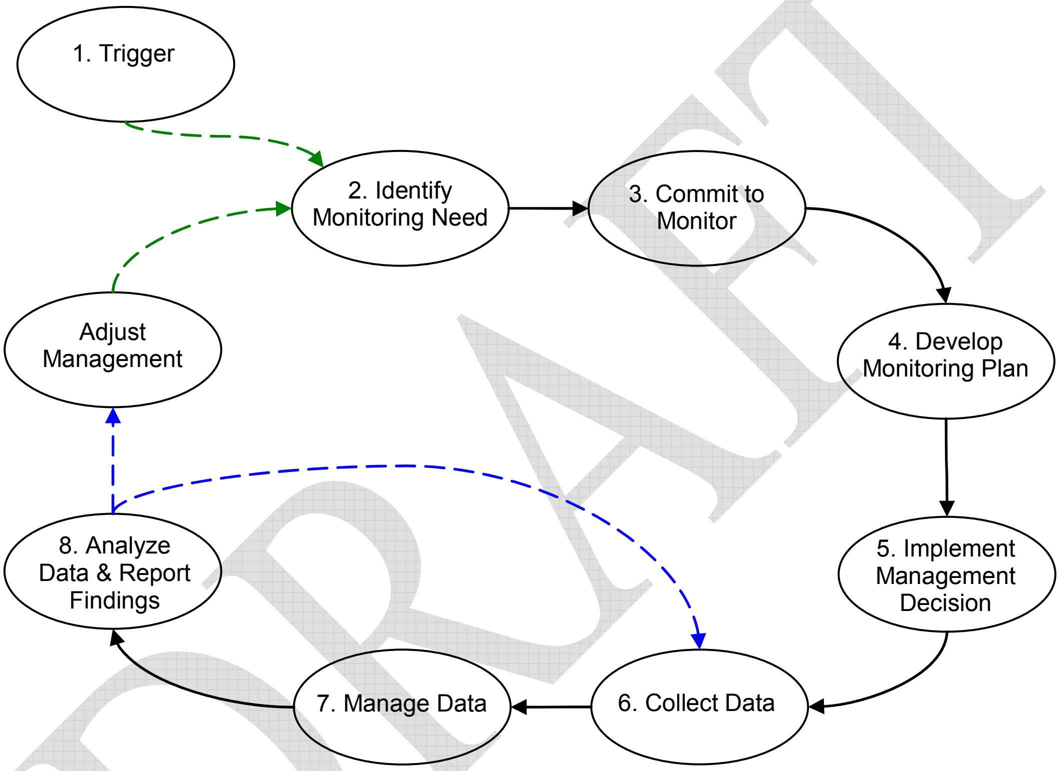
1. Trigger
2. Identify Monitoring Need
3. Commit to Monitor
4. Develop Monitoring Plan
5. Implement Management Decision
6. Collect Data
7. Manage Data
8. Analyze Data & Report Findings
Adjust Management

Figure 1: The Monitoring Process Model establishing key steps in developing an effective monitoring plan.

The local group used this "process" model to help design the field survey instrument (Survey Questions Tab). A more detailed version of this "process" model was developed as part of the Business Process Re-engineering efforts and presented in the appendix of the BPR Tab. As indicated in the above figure, the critical first step is the identification of management questions. The National Monitoring Strategy work group took a first cut at identifying critical management questions at various scales, which are found in the Management Questions Tab.

Another important critical step in the development of a successful inventory or monitoring program is the use of ecological "models" to help identify significant ecological components and relationships. According to J. E. Gross in Developing Conceptual Models for Monitoring Programs, 2003, conceptual models are a key element of environmental monitoring programs as they integrate current understanding of system dynamics, identify important processes, facilitate communication of complex interactions, and illustrate connections between indicators and ecological states or processes. Well-

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constructed conceptual models, Figure 2, provide a scientific framework for the monitoring program and justification for the choice of indicators.

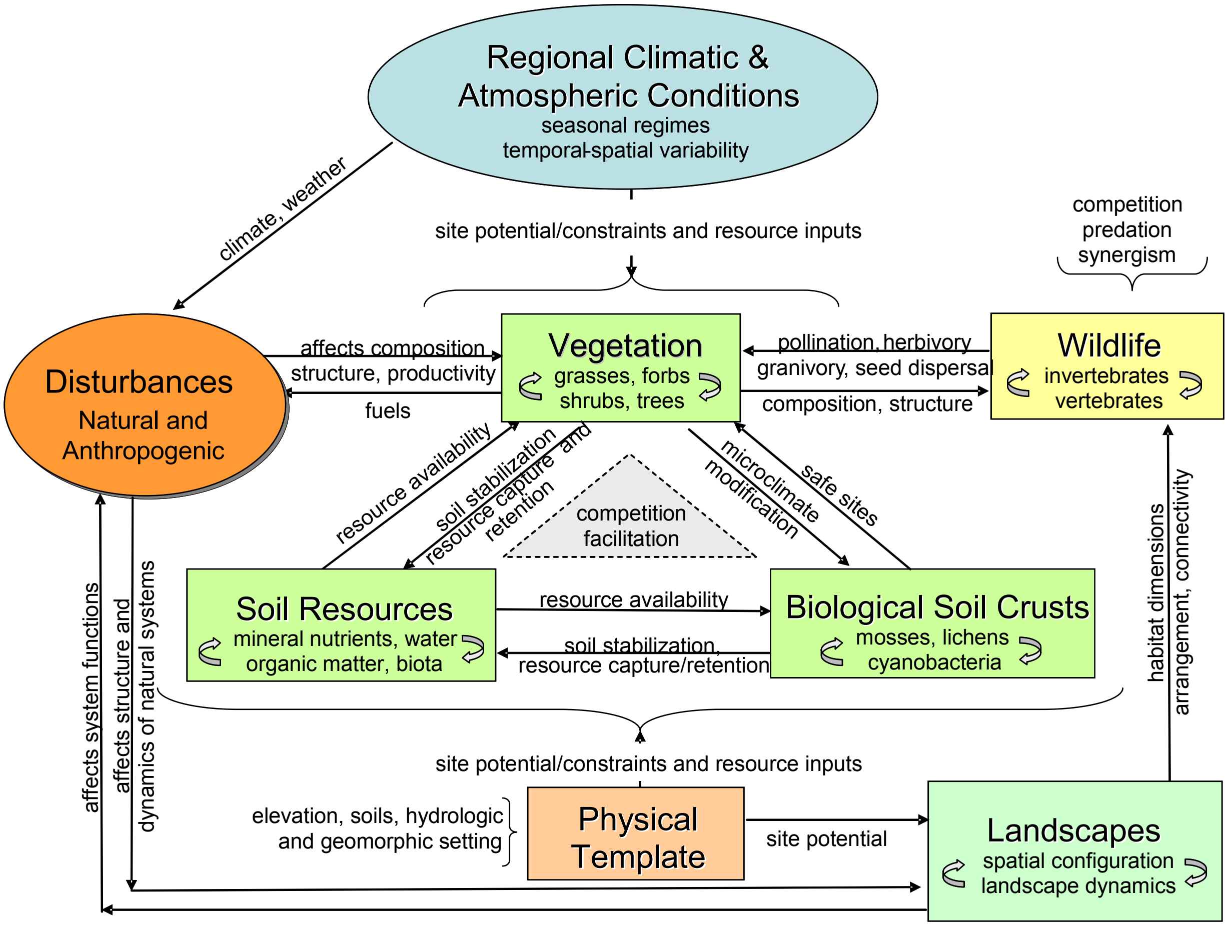

Figure 2: Conceptual ecological model illustrating key structural components (rectangles) and functional relations (arrows) of ecosystems. Ovals represent natural drivers of temporal variability and change (adapted by USGS from Miller 2005).

The land health fundamentals discussed in H-4180-1 are based on an ecological model discussed in the National Research Council's 1994 report, Rangeland Health, New Methods to Classify, Inventory, and Monitor Rangelands. Thus, it represents the type of broad based model the Bureau can use to unite monitoring efforts.

BLM's financial records for 2006 indicate approximately $190 million were charged to program elements relating to assessment, inventory, and monitoring activities. This spending does not correlate well with program accomplishments. The 47 program elements referred to above lack common definitions of work accomplishments, suggesting opportunities for consolidation and clarification.

In the process of preparing this report, the Workgroup compiled a catalogue of current monitoring methods identified by the Bureau's program leads; a synopsis of related manual sections, handbooks, technical references; and related training opportunities offered at NSTC. The BLM does not have a central repository for such information making this task frustrating and difficult to accomplish. This compilation reveled that monitoring methods are often redundant; guidance is often dated, sometimes contradictory, and not cross-walked between programs; and training opportunities are inadequate.

Additionally, developing readily accessible repositories for guidance, training, and on-going monitoring activities would further integrate the Bureau's monitoring activities.

3.2 Findings

3.2.1 The Bureau's existing guidance and training for monitoring activities is not grounded in a cross-program understanding of the basic components for a successful monitoring program. A shared Process Model would facilitate the understanding of the Bureau's monitoring needs and could serve as the basis for program-specific guidance, training, budgeting and performance reporting

3.2.2 The Bureau's existing data collection and data analysis activities are not grounded in a cross-program "ecological" model. A shared ecological model built on the Bureau's existing land health fundamentals would further facilitate the understanding and potential utility in integrating these activities.

3.2.3 The Bureau's inventory, assessments, and monitoring-related budget guidance and performance reporting are not well integrated across programs.

3.2.4 The Bureau does not have a central, readily available repository for monitoring guidance, training, or monitoring activities.

3.3 Recommendations

3.3.1 Update MS 1734 to include policy and methodology for integrated inventory, assessments, and monitoring processes and responsibilities. At a minimum, this guidance should:

3.3.1.1 Establish a generic Process Model outlining the critical components of a successful monitoring program.

3.3.1.2 Identify key management questions at the local, regional, and National scale.

3.3.1.3 Present a basic "ecological" model identifying key ecological components and relationships.

3.3.1.4 Clarify WO/NOC/SO/DO/FO responsibilities for inventories, assessments, and monitoring activities (e.g., State offices are responsible for QA/QC).

3.3.1.5 Standardize terminology related to inventory, assessment, and monitoring.

3.3.1.6 Clarify the relationship between the new policy and existing Manual Sections and Technical References.

3.3.2 Upon completion of the above policy, review the following budgeting and performance reporting requirements to:

3.3.2.1 Recommend steps for further integration of the Planning Target Allocation and the Annual Work Plan across programs.

3.3.2.2 Recommend steps for further integration of performance reporting across programs.

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3.3.3 Upon completion of the above policy, review existing training and identify unmet needs including training at the management level emphasizing integration of monitoring activities.

3.3.4 Upon completion of the above policy, expand use of web-based information:

3.3.4.1 Develop a web-based tool to access guidance, methods, and training opportunities.

3.3.4.2 Upload the Bureau's method protocols and monitoring sites to the web-based DOI Library and communicate availability to the field offices.

Sign-off: 200/300 and DD Operations
Task: WO DAD 200

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4.0 IMPROVE INTEGRATION OF DATA COLLECTION AND ANALYSIS WITH THE DEVELOPMENT AND IMPLEMENTATION OF LAND USE PLANS

4.1 Background

The BLM has been preparing Land Use Plans to help guide the management of the public lands since the 1970s. The Bureau's current planning regulations date from 1983 and the current manual and handbook guidance date from 2005. Resource inventory, assessment, and monitoring activities are discussed in both the regulations and the guidance. Monitoring, for example, is discussed in Section 1610.4-9 of the regulations and in Section V of the Land Use Planning Handbook.

There appears to be a significant amount of variation from one field office to the next and one program to the next in terms of the extent to which the Bureau's data collection and analyses activities and land use planning activities are integrated. The Field Survey suggests, there is better integration of these activities in the Pacific Northwest than in other regions. Similarly, it suggest there is better integration in the forestry/range/riparian programs than in other resource areas.

As evidenced by a number of recent Program Assessment Rating Tool (PART) evaluations, The OMB expects the BLM to systematically report on Land Use Plan monitoring results including plan implementation and plan effectiveness. The OMB also expects the BLM to systematically use this information to help identify investment priorities and to demonstrate the effectiveness of such investments.

4.2 Findings

4.2.1 The Bureau's assessment, inventory, and monitoring activities are not sufficiently integrated with the Bureau's existing procedures for developing, implementing, and evaluating Resource Management Plans (RMPs). For example, some NLCS areas have found monitoring activities were not collecting the data needed to enable managers to evaluate whether their decisions were meeting the goals of the RMP. To address this need at the Las Cienegas, The Nature Conservancy helped the BLM develop an integrated monitoring plan for the NCA without requiring any increase in funding for data collection and analysis.

4.2.2 The Bureau's existing procedures for developing, implementing and evaluating RMPs are not well integrated across the resource programs. For example, the Analysis of the Management Situation, the formulation of resource condition objectives, the estimation of effects, and other critical steps in the development of an RMP tend to be organized by resource program rather than around a shared ecosystem model such as the Fundamentals of Land Health.

4.3 Recommendations

4.3.1 Update MS 1601 to include policy for integrating assessment, inventory, and monitoring with planning. At a minimum, this policy should:

4.3.1.1 Encourage regional strategies for proactive inventory and syntheses of existing resource data that integrate across programs and are timed to support planning efforts.

4.3.1.2 Require cross-program characterization of current landscape condition and of desired condition based on the Land Health Fundamentals and the Land Health Standards.

4.3.1.3 Reinforce existing requirements for Resource Management Plan monitoring and for periodic reports on RMP implementation and RMP effectiveness. Incorporate these requirements into ongoing alternative control review plan evaluations.

4.3.2 Develop templates and compile examples of integrated Management Situation Analyses, integrated landscape condition objectives, RMP monitoring plans, and RMP evaluations.

4.3.3 Provide 1610 funding for development of implementation strategies and reporting on plan implementation effectiveness, including monitoring activities at the Land Use Plan level.

Sign-off: 200/300 and DD Operations
Task: WO DAD 200

5.0 ACQUIRE AND MANAGE RESOURCE INFORMATION AS A CORPORATE ASSET

5.1 Background

Over the last several years BLM has taken a number of critical steps toward managing the agency's natural resource data as a corporate asset including:

- Establishing Bureau-wide data management policies and procedures including Manual Section 1283 and Handbook H-1283-1, Data Administration and Management;

- Providing training for BLM data administrators and stewards;

- Developing a Geospatial Services Strategic Plan;

- Developing a "blueprint" for e-Planning ; and

- Completing "baseline" assessments of the national systems managed by AD-200 and AD-300;

- Convening a business process re-engineering workgroup to evaluate BLM's existing vegetation, air and water quality managing activities

In some program areas, BLM has made significant progress in using this data management "framework" to establish corporate data standards and to develop corporate data bases. Examples

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include cultural resources and asset management. In other areas, such as vegetation, data standards and storage have not yet been addressed.

It is critical that BLM select a small number of critical data themes, like vegetation, and for each of these areas and develop specific proposals for data capture, storage and reporting.

5.2 Findings

5.2.1 The BLM has not completed an architectural blueprint for natural resource data.

5.2.2 The BLM does not have a systematic, program driven strategy for standardizing data collection, storage, and reporting.

5.2.3 The BLM does not have standard data collection, storage, or reporting as indicated by the following findings:

5.2.3.1 More often than not, data are collected on paper and stored in file cabinets or boxes at the home unit. Paper is not smart management of data. This has led to cases of poor quality data, loss of data, or lack of access to data that could be of value to other programs or projects.

5.2.3.2 Resource data is not collected, stored, or reported in a manner that facilitates effective sharing, reuse, or the ability to answer strategic management questions from this information.

5.2.3.3 The inability to share or compare resource data or analyses makes it difficult to prioritize investments or demonstrate results at the field office, regional, or at the National scale.

5.2.4 The BLM has spent tens of millions of dollars collecting various kinds of data since the late 1930s. Until recently, the vast majority of this data has been stored via hard copy or on floppy/hard disks using now out-dated software (e.g. SVIM data on floppy disks using Aspen software). In its current format, most of this data cannot be used for any practical purpose.

5.2.5 Other agencies and individuals collect/possess data that pertains to or can be useful to public land managers. This includes, but is not limited to National Agriculture Imagery Program (NIAP), Soil Survey, Ecological Site Descriptions, etc.

5.3 Recommendations (In coordination with the Managing For Excellence Initiative)

5.3.1 Assemble team including architectural and geospatial experts and state data base experts to review the other agency efforts and to produce an architectural proposal for BLM.

5.3.2 Assemble team to identify and prioritize the data sets, e.g. water, soil, vegetation, threatened and endangered species, etc., for standardizing data collection, storage, and reporting. Develop a proposed MBO item for FY08.

5.3.3 Assemble a team of experts in the areas identified in Section 5.3.2 to standardize data collection, storage, and reporting. This process would be repeated until all of the data themes are complete and would include the following:

5.3.3.1 Data Collection
Gather and document requirements for electronic data collection units.

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Identify common data across the program.
Identify what data is corporate and can/should be “rolled up.”
Create standard forms with standard data fields for data collection.

5.3.3.2 Data Storage
Establish standard web-enabled State/Regional data libraries.
Designate State, Regional/National, or other servers to be used to store local, regional, and national data.

5.3.3.3 Reporting
Ensure easy access/interface to State/Regional data storage libraries.
Provide analysis and reporting capabilities utilizing the data storage libraries.

5.3.4 Develop and implement a corporate strategy to convert historic/legacy data to reusable electronic format.

5.3.5 Outline a process with guidelines for acquisition and management of large external data sets.

Signoff: OFA/200/300/500 and DD Operations
Task: WO DAD 200

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APPENDIX TO THE LOCAL REPORT

A: Strategy Briefing for the Field Committee

Actions to Date

- Initiated the strategy in 2005 at the request of OMB/DD.
- Met with other agencies and held several initial workshops.
- Developed a structured process for evaluating BLM's inventory, assessment, and monitoring activities.
- Agreed to initially focus on natural resource occurrence, condition, and trend.
- Hired a project manager and established a management oversight team and a core team to guide the strategy.
- Established 3 working groups to focus on natural resource information management needs at the Local, Regional, and National scales.
- Completed action plans for each workgroup with many final products to be delivered this year.
- Briefed the Deputy Director of Operations in February, 2007.

Next Steps

- Brief the management oversight team on the Local group's findings and recommendations in May.
- Organize a BLM/USGS WO Coordination meeting to develop a Regional Assessment and Monitoring Process Model
- Meet with the interagency cadre on Indicators of Rangeland Health to refine the Regional Assessment and Monitoring Process Model
- Brief other management teams as appropriate on the Local group's findings and recommendations, e.g. WO Division Chiefs, DSDs, and FC.
- Prepare final recommendations from the Local group for AD/DD action.

Observations

- OMB, CEQ, USGS, and the Sustainable Rangeland Roundtable are very interested in this strategy.
- Workgroup recommendations will be phased over several years to keep the workload manageable.
- Workgroup recommendations will help enhance the overall efficiency and effectiveness of BLM's data collection and analysis activities.
- Workgroup recommendations will help clarify the division of labor between the Washington Office, the National Operations Center, and the Field with respect to data collection and data analysis activities.
- The structured thought process used by the workgroups should be applied to other critical areas such as commodity uses, recreation, and heritage resources.

- Managing for Excellence has recognized the data component of the National Monitoring Strategy as one of several complementary “data management” initiatives in BLM and DOI. Others include the ITIB directed baselining of the national applications and of the IT infrastructure, the planning and NEPA blueprint, the geospatial blueprint, the geospatial services strategy, and the Oregon data model.

PROCESS FOR EVALUATING DATA COLLECTION AND ANALYSIS ACTIVITIES

High-Level Process Model for Assessment, Inventory, and Monitoring Information	
#1. Identify Management Needs	A. Identify information needed to support budget processes
	B. Identify information needed for plan development, implementation, and effectiveness evaluation
	C. Identify information needed for permitting, project development, and effectiveness evaluation
#2. Acquire Data	A. Identify data required to meet management needs
	B. Identify internal and external data sources
	C. Develop standard protocols to acquire data
#3. Manage and Analyze Data	A. Develop data entry, storage, and management requirements
	B. Develop data analysis methods
	C. Develop data reporting requirements

MONITORING STRATEGY AND THE DOI MISSION AREAS

	DOI Mission Areas					
	Resource Protection		**Resource Use**		**Recreation**	**Serving Communities**
	Natural Resources	Heritage Resources	Energy and Minerals	Forage and Forest Products		Fire Suppression, Realty, and Travel Management
National	X					
Regional	X					
Local	X					

Initial focus of the National Monitoring Strategy

GOALS AND OBJECTIVES FOR THE NATIONAL MONITORING STRATEGY

Goals	Objectives
Integrate inventory, assessment, and monitoring into BLM planning and other management decisions	Integrate data collection and analysis into the budget decision process, i.e. support resource allocation
	Integrate data analysis into development and implementation of LUP
	Integrate data analysis into project and permit planning and evaluation
Develop process to periodically report on resource occurrence, condition, and use at multiple scales	Identify a limited number of indicators to assess resource occurrence, condition, and use
	Identify internal and external sources for resource data
	Develop protocols for analyzing and reporting resource occurrence, condition, and use
Integrate and standardize data management in the Field	Develop GPS-referenced, field data collection device
	Develop shared data bases
	Develop standardized reporting formats

B: Management Questions at the National, Regional, and Local Scale

Management Questions Addressed at the National Scale					
	ASSESSMENT, INVENTORY, AND MONITORING	**IMPLEMENTATION/ COMPLIANCE**	**EFFECTIVENESS**	**VALIDATION**	**ADAPTIVE MANAGEMENT**
GENERAL QUESTIONS	**What are resource occurrences, opportunities, conditions, trends, stressors, and challenges?**	**Is BLM doing what it said it would do in its decisions, and are authorized users following our requirements?**	**Are BLM's resource objectives being achieved as a result of its actions (e.g., authorizations, allowable uses and treatments)?**	**Are the assumptions and conceptual models that underlie BLM's decisions correct?**	**If resource objectives are not being achieved, what adaptive management decisions can BLM make to achieve the objectives?**
CONDITION - GENERAL	What are resource conditions and trends on the public lands?	Are actions being implemented - by BLM or by users of public lands - that will cause changes in condition over time? If conditions are changing, what changes in use will occur?	Are BLM's actions on public land effective in maintaining or improving condition over time?	Are the methodologies BLM uses to report on condition scientifically defensible, and have they been peer reviewed?	

NATIONAL QUESTIONS CONTINUED

CONDITION - BASED ON LH ASSESSMENTS	How many units, i.e. acres or miles, are achieving the upland, riparian, habitat, and water quality land health fundamentals? For the units not achieving the upland, riparian, habitat, and water quality land health fundamentals, what are the causal factors?	Are BLM's management actions designed to increase the units meeting land health fundamentals?	Are areas meeting land health fundamentals increasing over time?	Has the Land Health Assessment (LHA) process been peer reviewed? Does the information on condition obtained through the LHA agree with other national-level condition information?	Does BLM amend its LHA process based on new information?
EFFECTIVENESS	Are goals and objectives expressed using common measures and terminology, so that effectiveness can be demonstrated at different scales?	Is BLM implementing its land use plans (i.e., are resources allocated to meet the plans' goals and objectives)?	Are BLM's land use plans effective (i.e., are the plans' goals and objectives being realized)?	Do effectiveness measures of land use plans accurately portray BLM's contributions to natural resource condition?	Can management alternatives be implemented that result in better achievement of Bureau-wide goals and objectives?

Management Questions Addressed at the Regional Scale

	ASSESSMENT, INVENTORY, AND MONITORING	IMPLEMENTATION/ COMPLIANCE	EFFECTIVENESS	VALIDATION	ADAPTIVE MANAGEMENT
GENERAL QUESTIONS	What is the condition of key resources that BLM's decisions may cumulatively impact (e.g., air, water, wildlife habitat)? What is the nature and extent of uses on BLM lands within the affected region? To what extent do BLM projects or permitted uses contribute to changes in condition at a regional scale? Does BLM have models in place to predict changes in resource condition over time at a regional level?	Are management requirements (including mitigation measures) being implemented within the affected region? Are regional level thresholds established for changes in resource condition? Are these thresholds being approached?	Is BLM achieving its management objectives? Are the management requirements effective? Are the management requirements appropriate?	Did models that estimated effects of BLM projects and authorized uses accurately predict resource changes?	If objectives for BLM projects and mitigation of permitted uses are not being met, is BLM adapting its management actions?

REGIONAL QUESTIONS CONTINUED

ENERGY		Are stipulations and conditions of approval being implemented? What is the extent of reclamation activities?	Are stipulations and conditions of approval effective?		If objectives for development or reclamation are not being met, is BLM adapting its management actions?
TRAVEL AND TRANSPORTATIO N	Within a regional use area, where, when, and why is travel and transportation (T&T) use occurring and at what intensity?	Within a regional use area, has BLM placed requirements on T&T in its decisions?	Are BLM's management actions moving the region toward BLM's objectives?	Are T&T activities affecting other users within the region? If so, what are those activities and where are they occurring?	
SAGEBRUSH	What is the status, distribution, and trend of sagebrush communities? What is the status, distribution and trend of invasive species or other stressors that affect sagebrush habitat?	What kinds of treatments have been implemented to maintain or restore sagebrush habitat integrity and where have they been implemented?	Do targeted treatments increase or improve sagebrush habitat at a regional level?		

Management Questions Addressed at the Local Scale					
	ASSESSMENT, INVENTORY, AND MONITORING	**IMPLEMENTATION/ COMPLIANCE**	**EFFECTIVENESS**	**VALIDATION**	**ADAPTIVE MANAGEMENT**
GENERAL QUESTIONS	**What are resource occurrences, opportunities, conditions, trends, stressors, and challenges?**	**Is BLM doing what it said it would do in its decisions, and are authorized users following our requirements?**	**Are BLM's resource objectives being achieved as a result of its actions (e.g., authorizations, allowable uses and treatments)?**	**Are the assumptions and conceptual models that underlie BLM's decisions correct?**	**If resource objectives are not being achieved, what adaptive management decisions can BLM make to achieve the objectives?**

LOCAL QUESTIONS CONTINUED

PLANS	Are the proper ecological processes being achieved based on kind, amount, and proportion of vegetation? What is the ecological potential of the area? What is the condition of resources in the planning area? How should uses of those resources be allocated? Should any lands be specially managed, retained, acquired, or disposed of? What is the likely effect of the proposed Federal action?	Are goals and objectives written in a way that they can be implemented? If so, are the goals and objectives being implemented? Have travel management plans been developed and if so are they being followed?	Are goals and objectives being realized through benchmarks identified in the LUP/activity plan and any associated monitoring plans? Is T & T occurring within the planning area as projected?	Were models (implicit or explicit) used to predict effects of the proposed Federal action accurate? Are T & T user needs being met?	As part of plan evaluation, did the affected unit adapt its management in response to information about meeting or not meeting LUP and T&T goals and objectives? Do monitoring results indicate the need to adjust LUPs or activity-level plans?

LOCAL QUESTIONS CONTINUED

PERMITS	Are the activities proposed for permitting consistent with allocated uses in the LUP? If not, should the LUP be amended? Are there special status species within the area proposed for permitting? Are the "terms and conditions" of use specified in the permit? What is the likely effect of the proposed Federal action?	Are permit "terms and conditions" being met?	Does compliance with "terms and conditions" of permits produce the projected results?	Were models (implicit or explicit) used to predict effects of the proposed Federal action accurate?	Do changes in resource condition cause adjustment of permit "terms and conditions"?
PROJECTS	Does the LUP identify the need for BLM to implement a project? What project will address this need?	Was the project implemented as prescribed?	Did the project adequately address the need identified in the LUP?	Did the office that implemented the project assess whether the chosen method was most appropriate?	Did the validation of methods used for the project bring about any change in prescription for subsequent projects?

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C: Chronology of Monitoring Activities

1775	Professionals engaged in the survey of the Public Lands of the United States were required to describe the lands and resources adjacent to monuments in their field notes. Some of these individuals were highly skilled naturalists who recorded an accurate picture of existing vegetation prior to settlement. These descriptions could serve as a representation of the potential vegetation across the landscape.
1930s	Personnel from the Civilian Conservation Corps (CCC) used a Pantograph device to inventory 2 to 3 plots per grazing district. The technique was used to document trend, cover, and production. The primary drivers for this data collection were drought evaluation, support for livestock capacity decisions, and vegetation research. Data were recorded in the form of a graph paper sketch representing actual plants within the plot and sites were read as late as the early 1950s.
1940s	A Soil Moisture Evaluation technique was developed by predecessors to the SCS/NRCS. The technique was used extensively in New Mexico to gather information to characterize soils and ecological sites.
~1951	Parker Three Phase Transects were initiated in several BLM grazing districts. Transects were designed to measure composition, species frequency, and bare ground. They were not intended to yield information on production. The transect methodology was adopted in part in response to watershed concerns and an invasion of Halogeton.
~1956	The Demming Two Step methodology was adopted by the BLM to determine the condition of the rangelands and to acquire baseline information relating to relic sites. Data were used in watershed monitoring, soil and water inventory, and to support livestock stocking decisions.
~1958	Step Point (Notched Boot) method adopted in the late 1950s to evaluate watershed conditions in associated with the Vale Projects. The method was used to determine vegetative composition, cover, and frequency and gave an indication of trend over time.
1960s	Low-level aerial photography was used on a limited basis in Battle Mountain, Nevada in an effort to delineate species composition and cover. Pilot testing indicated that the technique was useful only for determining vegetation types.
1960s	Range and wildlife utilization monitoring was conducted to determine how much vegetation was being consumed. The monitoring was pasture-based and measured stubble height. The technique was first applied in conjunction with allotment management plans in the mide-1960s. It is used to establish the level of use with regard to management objectives.
~1965	Trend Plots were implemented in the mid-1960s to determine if the BLM was meeting planning (allotment management plan) objectives. The technique was used to estimate the trend of vegetation in allotments, riparian areas, and meadows.
1960s	The frequency frame method employed a frame technique using key indicator species. The frequency of occurrence of key species was a determinant of trend over time. The protocol was used at Battle Mountain, Montrose, and Tucson (FS).

1970s	Watershed Phase I and Phase II inventories were conducted at several field offices including Albuquerque District Office and Badger Wash, Colorado. Data were used to calculate runoff from the Mancos shale and was the basis for calculating Erosion Soil Surface Factor (SSF).
1976	FLPMA was signed into law and defined BLM's mission as one of multiple use and provided a framework to manage public lands in perpetuity, for the benefit of present and future generations.
1978	The Soil Vegetation Inventory Method (SVIM) was developed in response to legal and political requirements and was implemented to determine grazing capacity and potential. The process was scientifically defensible and repeatable and used extensive modeling and data inputs.
1980	Promulgated rule to implement the planning rules of FLPMA - BLM 43CFR.
1983	Manual section 1734, Inventory and Monitoring Coordination, was signed and established as Bureauwide policy and standards for coordination of inventory and monitoring activities.
1993	Handbook H-1261-1, AIM Project Structure, (Automation/Information Resources Management Modernization (AIM)) released as an ongoing initiative to modernize the BLM's business.
1994	National Research Council released *Rangeland Health: New Methods to Classify, Inventory, and Monitor Rangelands*
9/1994	BLM released the *Blueprint for the Future* with a land health goal and associated inventory, monitoring and assessment strategies.
9/1996	Jim Stone prepared paper entitled *"Resource Monitoring on the Public Lands: Building an Integrated Approach"* which discusses the NRI Pilot Project, Standards and Guides, and Qualitative Assessments.
2/1997	Maitland Sharpe delivered a paper entitled *"National Rangeland Condition Reporting Needs for the BLM*" at an SRM meeting in Rapid City.
7/1998	ELT Healthy Lands Work Group surveyed the field concerning the development of land health standards for a July workgroup meeting. (Denver)
7/1998	ELT discussed land health standards and the Comb Wash decision. ELT agreed that Standards would be incorporated into land use plans, would apply to all lands, and would be used by both AD 200 and AD 300 to evaluate management practices. (Denver)
11/1998	ELT Healthy Lands Working Group prepared progress report on land health follow-up actions, including recommendations on NEPA guidance and training, additional guidelines, and tracking and reporting on progress.
11/1998	ELT discussed assessments and permit renewals; standards and guides – beyond range; and TNC's ecoregion based conservation strategies. (Phoenix)
3/1999	ELT discussed TNC's ecoregion planning; planning guidance; and the Heinz Center's Environmental Report Card. (Boise)
7/1999	Jim Stone prepared a paper outlining a proposed assessment strategy focusing on intermediate level assessments using a small set of condition, risk and opportunity indicators with sub-basins as the standard reporting unit.
7/1999	ELT discussed sub-basin assessments and multi-species listing. ELT agreed to develop a proposal for re-engineering the assessment consultation process and a proposal to communicate BLM's increasing critical mission to provide habitat for conservation of multiple species. ELT also agreed on criteria for identifying and ranking "hot spots". (Easton)
9/1999	ELT discussed a proposed strategy for conducting sub-basin assessments including benefits for the BLM and a recommended process for refining the proposal and conducting demonstration pilots focusing on a limited number of priority sub-basins. ELT agreed to the general direction but asked AD 200 and AD 300 to clarify the purpose, clarify links to existing

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	processes, and ensure that the enterprise architecture team is familiar with the proposal and its potential impacts on data management. (Eureka)
10/1999	Assessment Strategy Workgroup met in Denver. Workgroup reviewed results of Phoenix meeting and of the ELT meeting; discussed the purpose of the strategy, the relationship with planning and appropriations; and outlined national and regional level questions.
10/1999	Assistant Directors met in Gettysburg and agreed to create an assessment activities team to develop a set of minimum indicators, a protocol for reporting assessment results, and recommended pilots.
12/1999	Jim Stone prepared a paper on “assessment strategy indicators”.
12/1999	Assessment Strategy Workgroup met in Phoenix to discuss (1) uses, linkages, and deployment; (2) assessment framework and indicators; and (3) proposed workplan.
1/2000	Jim Stone prepared a revised “assessment strategy”.
1/2000	ELT discussed the proposed assessment strategy and agreed to conduct a prototype assessment at the national level by mid-July with recommendations to the ELT by September (Santa Fe)
2/2000	BLM submitted a report to Congress documenting the need to update the BLM planning base.
5/2000	Land Health Assessment Workshop held in Reno.
6/2000	ELT discussed the national assessment pilot, the range program; and the Great Basin initiative. (Phoenix)
7/2000	Resource Assessment meeting held in Denver - Meeting reviewed (1) overall approach for national, regional, and sub-basin assessments; (2) summary of state activities; and (3) various assessment papers including a report from the Regional Resource Assessment Sub-team of the Federal Leadership Forum Core Team.
9/2000	ELT discussed national assessment prototype, land health assessments, and planning. ELT agreed to establish a national assessment staff in Denver to refine and maintain the national assessment; to explore the role of the national staff in regional assessments; to hold a Bureau wide planning meeting; and to withhold 80% of new funding until preplans are prepared.
11/2000	President Clinton signed the Energy Policy Conservation Act (EPCA) Amendments of 2000
11/2000	Congress increased funding for planning by $7million in FY 2001 budget
5/2001	President Bush’s *National Energy Policy* directed the EPCA inventory be expedited
11/2001	Congress directed the BLM to “submit to Congress a report detailing the status of (1) resource monitoring efforts, (2) current capabilities and adequacy of existing resources, and (3) recommendations to address the Bureau’s need to monitor resource conditions.” Congress also directed the BLM, NRCS, and USFS to charter an interagency group to address rangeland assessment and monitoring issues, including a plan to complete standardized soil surveys and ecological classifications.
2/2002	In response to a Budget Strategy Team survey, many national constituent groups identified inventory and monitoring as areas with insufficient funding
9/2002	The Heinz Center released *The State of the Nation’s Ecosystem*, a project the Center took on at the request of the White House’s Office of Science and Technology Policy and funded in part by the Department of the Interior
2/2003	DOA, DOE and DOI published the EPCA Phase 1 report
2/2003	OMB identified “gaps in monitoring of resource conditions to support management decisions” as a finding in an assessment of BLM’s restoration activities
2/2003	The President’s FY 2004 budget request included a $1.9 million monitoring initiative

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4/2003	DOI asked the BLM to highlight resource monitoring in its FY 2005 budget request
2/2004	The President's FY 2005 budget request included a $4 million monitoring initiative
6/2004	DD/AD's agreed to take a "hard look" in response to OMB's requests concerning monitoring
7/2004	DD/AD's agreed to sponsor a workshop focusing on land health related monitoring.
8/2004	Held the land health monitoring workshop in Denver. The key management questions relating to land health were identified. Also, action items were proposed for local, regional, and national scales. (See the *Background and Scope* paper dated 8/17 and the *Preliminary Recommendations* paper dated 8/30.)
8/2004	Briefed DD/AD's on the outcomes of the Denver workshop. Core Team directed to guide the development of detailed action plans outlining proposed accomplishments for FY 2005 at each scale
9/2004	Briefed OMB on the outcomes of the Denver workshop
10/2004	BLM's Financial Auditors raised questions about the Bureau's compliance with the Federal Financial Accounting Standard for reporting on the condition of its "*stewardship assets*"
10/2004	Met with CEQ, USGS, the Heinz Center and others concerning the monitoring strategy. (See *General Concepts* paper from USGS and *Summary* paper dated 11/8/04.)
11/2004	GAO concluded that none of the Federal agencies, including BLM, have systems in place to gather and use information on legal challenges to oil and decisions.
1/2005	Held a second workshop in Albuquerque. (See *Briefing Note*s dated 1/28/05 and the *Status Report* dated 2/9/05.)
2/2005	OMB briefed on the outcomes of the Albuquerque workshop
3/2005	ELT briefed on the monitoring strategy on an ELT conference call
5/2005	Convened a meeting of the project leads to enhance the integration of the projects across different scales. (See *Status Report* dated 6/01/05.)
6/2005	DD/AD's briefed on the strategy
6/2005	GAO concluded that the BLM's "environmental protection responsibilities" have not kept pace with oil and gas permitting
7/2005	Project manager hired for the monitoring strategy
7/2005	Director briefed on the AIM strategy
9/2005	Oversight Team held initial meeting
9/2005	DD-Policy testified before Senate Energy and Natural Resources Committee's on "Public Rangeland Management and Livestock Grazing on Public Lands", including rangelands relating monitoring
10/2005	Annual Work Plan guidance issued on the monitoring strategy
12/2005	Prepared briefing for OMB on the national monitoring strategy
5/2006	AIM Oversight Team meets in Washington, DC
5/2006	Field Committee briefed on the AIM strategy
6/2006	IM 2006-169 transmits the Field Survey to the Field.
10/2006	ELT briefed on habitat connectivity analysis
10/2006	ELT briefed on the AIM strategy
10/2006	Business Process Reengineering of air, water, soil, and vegetation initiated

11/2006	DOA, DOE, and DOI publish EPCA Phase 2 report
2/2007	DD-Operations briefed on the AIM Strategy
3/2007	Updated the OMB on the status of the National Monitoring Strategy
5/2007	Briefed the Field Committee on the status of the National Monitoring Strategy

DRAFT

D: Legacy Reports Describing Monitoring Activities

FY 2002 Report – A Legacy of Land Treatments

Executive Summary

The focus for 2002 was on vegetation treatments such as sagebrush control, piñon-juniper chaining, grass reseeding, and prescribed fire. The goal was to evaluate these past land treatments in several representative areas: eastern Oregon, southcentral Idaho, western Colorado, and central Wyoming.

Land treatments are investments that need to be tracked, evaluated, and maintained throughout their effective lives. Proper management of treated areas, including use monitoring and use adjustments, is a critical aspect of protecting those investments.

The 2002 Legacy field visits pointed out the need for a Bureau-wide commitment to long-term ecological monitoring and proper data management. We believe that volunteers, especially retirees, could be used effectively for monitoring and data management activities.

Introduction

The field visits were not formal evaluations. The goal was to observe these older projects and learn from them and from the people who worked on them. The teams did not have the time, nor was it our objective, to do an in-depth scientific analysis of the land treatments. The door was left open for field offices to follow-up with more in-depth evaluations or monitoring of the project results and site conditions.

Land Treatments in the Arid West – Lessons Learned

Land treatments are investments with finite lives and the BLM has the responsibility to protect those investments. To maximize the return from those investments, treated areas require periodic inspections, use monitoring, evaluations, maintenance, and proper post-project management.

Post-project evaluations are important learning tools and should be conducted periodically following all land treatments. Evaluations of the Vale Project were done by university scientists (Heady and Bartolome, 1977; Heady, 1988), thus providing an independent, unbiased view of those land treatments. It was the consensus of the Legacy team that initial evaluations of land treatments should be done within five years following project completion and every 10 years thereafter. Since the Vale Project was last evaluated in 1988, another evaluation should be completed in FY03 or FY04.

Most field offices had kept and maintained their project records. However, in a few cases records had been lost. Proper data management is an important facet of the land treatment legacy and its importance cannot be overemphasized. Record files should include original project documentation on the planning and implementation phases, monitoring data and interpretations, inspection and evaluation results, and photographs.

There was no consistent approach to monitoring of the land treatments that were visited. Monitoring of project results, use monitoring and long-term monitoring of ecological conditions must be a Bureau-wide commitment. We address this topic in more detail in the following section. One of the most important lessons learned in the Legacy 2000 site visits was the significance and value of project documentation and record maintenance, including project description and objectives, baseline or reference area documentation, follow-up monitoring, data analysis and application of results. This is not a new or surprising finding, but important enough to deserve a separate section in this report.

Monitoring, Data Management and Reference Areas

The Importance of Long-term Monitoring

A common thread that ran throughout many of the sites we visited was the ubiquitous problem of the lack of monitoring data. In many cases project monitoring was not done, or it was done sporadically without consistent documentation, or monitoring was done but the records had been lost or destroyed. This is not a criticism of any single field office, but a universally-recognized shortcoming that needs resolution Bureau-wide.

It is worth noting that Bob Kindschy, wildlife biologist retired from the Vale District, was recognized in the 1988 evaluation of the Vale Project for his “foresight in establishing permanent plots to monitor change in vegetation, wildlife species populations, and riparian conditions” (Heady, 1988). Kindschy’s periodic sampling of those plots provided Dr. Heady’s evaluation team a more than 25-year-record of post-treatment conditions in the Vale Project area. Kindschy has continued to re-sample those plots on a voluntary basis, providing the Vale District with an extremely valuable long-term data set.

Monitoring must have well-defined objectives. Ed Spang reminded us that monitoring must be consistent, timely, and useable. Both managers and resource specialists must recognize the value of long-term, uninterrupted monitoring and make a firm commitment to funding and implementing appropriate monitoring activities.

We were particularly impressed with the Montrose Field Office’s “model” for monitoring. Montrose employs a full-time ecologist responsible for monitoring. The position is shared by several resource programs and funded by several subactivities. The Montrose model should be considered by BLM for implementation in other field offices, and perhaps also in the Washington Office.

Recordkeeping and Data Management

Good documentation, recordkeeping, and data management should accompany monitoring. Permanent sites used for monitoring, such as exclosures, transects, plots, and photo points, should be marked with GPS-located aluminum project markers and entered into the Rangeland Improvements Project System (RIPS) database. The availability of modern technology (GPS, GIS, digital photography, and computer-based data storage media) provides the BLM the opportunity to more effectively and efficiently accomplish project documentation and record management. The BLM may never recover the valuable data that has been lost or destroyed. BLM will probably not be able to digitize the available analog data that exists in hard copy files. A deliberate effort should be made to implement data management guidelines and requirements to capture and properly archive new monitoring data. This is particularly important and necessary in today’s times with the increasing emphasis by BLM management and the public on the application of good science in making BLM resource management decisions.

Reference Areas

BLM Handbook H-4180-1 (Rangeland Health Standards) defines ecological reference areas as landscape units in which ecological processes are functioning within a normal range of variability and the plant community has adequate resistance to and resiliency from most disturbances. Based on that definition, ecological reference areas may be selected to represent the ecological potential of a landscape unit in terms of ecosystem structure and function and biological health.

Exclosures represent one type of reference area. The 1977 evaluation of the Vale Project pointed out that many (approx. 70) exclosures were built in the Vale District for studies, plot monitoring, protection of riparian vegetation and wildlife habitat, and protection of reservoirs (Heady and Bartolome, 1977). Exclosures are important sources of “benchmark” information for evaluating adjacent treated and managed rangelands. If exclosures are to be used as reference areas, they must be maintained.

Untreated, unfenced areas in desired plant communities could also be used as reference areas for ecosystem restoration or vegetation manipulation projects. One example would be research natural areas. Laycock (1975) pointed out that rangeland reference areas might also include fairly large areas in good ecological condition, set aside or managed carefully to preserve or maintain that condition. Under that scenario, the reference areas could serve as comparison or control sites for land treatments or restoration projects.

Opportunities for Volunteers

The Legacy 2002 field visits suggested the opportunity for BLM field offices to use the experience and expertise of retirees as a resource to accomplish monitoring activities that could not otherwise be accomplished by a limited field office workforce. We identified several field-oriented opportunities for volunteers. Under the broad topic of monitoring, volunteers could assist field offices in monitoring, including the sampling of plots and transects, installing project markers at plots, transects, and exclosures, replacing signs, updating and maintaining records on past land treatments, retaking photo points, and collecting location information for permanent plots, transects, and exclosures for input to the RIPS database.

Conclusions and Recommendations

All the land treatments visited in 2002, whether deemed successes or failures, had value in that they provided opportunities for learning how different plant communities responded to various land treatments and how those responses were influenced by post-project management and by wildfire. Land treatments are investments that need to be tracked, evaluated, and maintained throughout their effective lives. Proper management of treated areas, including use monitoring and use adjustments, is a critical aspect of protecting those investments. Vegetation manipulations in sagebrush steppe and piñon-juniper often require re-treatment in 15 to 20 years. A better understanding of site potential and plant community dynamics, coupled with new technology (GPS, GIS) and wider variety of treatment options (mechanical, chemical, prescribed fire), provides enhanced opportunities for re-treating those areas.

The 2002 Legacy field visits pointed out the need for a Bureau-wide commitment to long-term ecological monitoring and proper data management. Reference areas, including both exclosures and unfenced areas, should be established at the initiation of a management treatment. They should be GPS-located, monumented, properly maintained, and consistently checked. Permanent transects and plots used for monitoring should be GPS-located, monumented, and entered into the RIPS database. Project records should include an inventory of exclosures, monitoring plots and transects, and should be properly maintained and archived. We believe that volunteers, especially retirees, could be used effectively for monitoring and data management activities.

Guiding Questions for the Legacy Program, FY 2002

4. Was monitoring included in the project? If so, what type of monitoring was conducted (transects, photo points, plots)?

5. If photo points were established, have they been re-taken recently?

Eastern Oregon: The Vale Project - Bob Kindschy, Al Logosz, Chad McBurney, Roger Mertens, Ed Spang

The areas reviewed and projects viewed did not reflect the long-term goals of the Vale Project. The personnel of the 1960's and 70's for some reason didn't leave sufficient tracts to insure continued intensive field management practices. It is now imperative that present and future land manager's look closely at the past developments on the ground, present-day uses and management. In doing so, these public lands not in acceptable condition must be managed for ecological resource improvement. Further, the legacy of the past with the improvements and administration actions are lost in only a few short decades unless actions of the past remain in full view of the District Employees.

We respectively request that the Vale Project efforts continue to be made available to all present and future personnel. District training programs should include in-depth information on the Project and subsequent year's activities. This would assure that the legacy would be carried forward allowing for aggressive and effective land management activities. If this is not done then the sole of the Vale Project will be lost forever.

We spent time at the CCC exclosure of 1939; it is adjacent to the Antelope seeding. This is an important "bench-mark'" site which, like most of the livestock exclusion sites throughout the District, provides an opportunity to judge management effectiveness on adjacent rangelands. (Photo's #6 and 7)

Exclosures are vital sources of "benchmark" information which enable evaluation of adjacent managed rangelands. It is strongly recommended that BLM update the inventory and maintenance needs of exclosures.

Two permittees, independent of each other, asked our group: "When was the last time BLM counted cattle?" This suggests that running more stock than licensed may be rather common. We couldn't help but wonder what the utilization, actual use and trend studies have been showing. It was a pity we weren't accompanied by some Vale range personnel.

Each of us wrote of our observations and shared them. We were in strong agreement that ecological problems were very evident. Although the urge to assign blame was strong, we felt present land managers -- both BLM and livestock grazers -- should review the files for past records of condition and trend, actual use, utilization, weather and climate, trespass and project maintenance.

Fenced exclosures throughout the district starting in 1939 and continuing into the early years of the Vale Project. Each exclosure contained transects and photo points as well as various land treatments, different plant species seeded, and undisturbed control areas.

Trend plots were first established in the treated areas starting in the mid 60's. These consisted of 3'X3' photo plots and wide angle photo shots. Browse transects where established and read in selected areas throughout the District.

We were told that some range studies are being conducted each year but the team was not provided access to this data.

Allotment monitoring studies (Trend, actual use, utilization and weather) should be keep current and summaries posted in each allotment file for use by the range staff.

Jarbidge Field Office; Twin Falls, Idaho - Gary Blincow

Traveled to all of the selected projects in the field to locate observation points and routes. I located some old photo locations that I had and duplicated the photographs.

Buffer sagebrush plowing and seeding of crested wheatgrass

Buffer Extension sagebrush plowing and seeding of crested wheatgrass

Buffer Extension re-drilling of crested wheatgrass

The cost per acre was $6.70. Total project cost was $70,350.

No monitoring was included in the project. A project feasibility report was completed in 1964 before the project was started.

No permanent photo points were established.

Uncompahgre Plateau - David Wickstrom

E. Pre-Project baseline data and or monitoring

1. Transects or plots - None that I recall
2. Photo points - None that I recall
3. Type and location of documentation: Annual work plans, project files, notations of cooperation with Colorado Fish and Game

D. Post project monitoring

1. Permanent wildlife transects established. Grazing use monitored
2. Photo points established.
3. Documents retained in District files
4. Information on the projects incorporated into planning documents.

Uncompahgre Plateau - George Hollis

Long-term monitoring: When the chainings were completed, wildlife and grazing monitoring systems were installed. Those included permanent plots and photo stations. Our review found that there no longer was record of all the work that was done in this regard. Attempts are being made to recapture information to establish a base to build continued long term monitoring programs. Why did these programs disappear? It does not reflect well on BLM as a responsible land manager when information is not recorded and passed on to succeeding employees. To continually start from scratch every time a vegetation treatment program is proposed does not make sense. We must learn from the past if we are to have a future.

Increase awareness of all employees about the importance of the retention of permanent files such as studies, inventories, evaluations, photo plots, etc. that program specialists worked diligently to establish/collect and complete. Establish the policy that each study, evaluation, inventory completed for a program/initiative is vital to management and must be preserved within the BLM records system.

Use volunteers (BLMers who are retired) or rehire annuitants to help field and/or office professionals with work that should be done, but cannot be accomplished without additional help such as: monitoring and evaluation studies, project supervision, records management, etc. Many retirees may be looking for just the right opportunity to get involved with field work again. Utilizing retirees as resource advisors for their experience, knowledge, perspective/view points, and/or just their expertise and skills to get the job done may be a large untapped resource for BLM.

Blue Mesa - David Wickstrom

C. Post-Project land management

1. Yearly monitoring of planted areas to determine survival success of seedings
2. Broadcast burning successfully removed heavy concentrations of wood debris
3. Salvage of wood products - mine timbers for the coal mines near Paonia and long poles for teed lot bunkers in Nebraska
4. Daily monitoring of grazing to keep sheep out of forest restoration areas

D. Post project monitoring

1. Yearly sampling over planted and seeded areas to determine mortality

4. Monitoring (use supervision and long term monitoring) Use supervision:

Monitor all permitted forest cutting

Watch for trespass cutting

Long-term monitoring:

Understand what has taken place in the past

Be aware of changes taking place, even though it may be slow

Write a short end of the year report *to* the permanent files of what transpired in the area during the year. I would keep it to one page with photos.

Make sure the person following you knows of this record and continues the effort.

Every five years review the information and prepare a paper on changes that have occurred.

Legacy Project, Worland Site Visit - James (Smokey) O'Connor

Monitoring studies were initiated in the Burnt Wagon area but this information was not available during the site visit. The project file contains photos taken in 1957-58 which show the furrows and the crested wheatgrass plants.

FY 2003 Report – Forestry and Engineering Activities

…They also provide an objective, unbiased perspective on land management practices and decisions. For example, Legacy volunteers over the past two years have unanimously recognized the need for long-term resource and ecological monitoring on BLM lands. Most retirees participating in the Legacy program have commented on the need for better project recordkeeping.

The Need for Long-term Monitoring of Resource Conditions

After two years of Legacy visits to a wide range of BLM field offices in most of the western states, we are seeing some definite patterns emerge. Retirees are asking questions about the status of resource monitoring. Many of them have asked about specific transects or plots or photo points that they initiated in the past. They want to know if these monitoring sites are still being read and what the results indicate. They have heard that a few of these sites were discontinued and/or abandoned. Some retirees have indicated they would be interested in helping field offices with resource monitoring.

The current problem is two-fold: 1) the maintenance and retrieval of records from existing permanent plots, transects, and photo points and 2) the proper selection, design, and implementation of new monitoring sites and protocols. Existing monitoring sites should be documented in the field office records, with GPS and map locations both noted, and aluminum project markers installed. These activities are well-suited for willing retiree-volunteers. It is possible that retired BLM employees could be used as volunteers by many field offices for the field collection and database entry of monitoring data.

As we concluded in the Legacy 2002 summary report, resource monitoring is a serious land management shortcoming that needs resolution Bureau-wide. With the pending retirement of a large percentage of BLM's work force occurring over the next few years (Durant, 2003), resulting in the anticipated rapid turnover of field office personnel, the need for a Bureau-wide data management system for resource monitoring is critical.

Older plots, transects, and photo points are particularly valuable, even if they have not been remeasured or retaken periodically. With the help of retirees, many of these sites may be located and remeasured. A good example is the San Simon watershed in southeastern Arizona, where retiree Mel Shilling established permanent transects and photo stations in the late 1950s and early 1960s. Mel is now working as a volunteer with the Safford Field Office, in collaboration with a University of Arizona graduate student, to locate and re-take the photo points.

There is a critical need for a Bureau-wide database of metadata covering monitoring sites and designated research, study, and reference areas. Metadata about permanent plots, transects, photo points, and designated research and reference areas should be entered into a Bureau-wide database. Permanent plots, transects, and photo points represent an important public investment. A study should be conducted to determine whether existing databases, such as the Rangeland Improvements Project System (RIPS), could be modified for this purpose or if a new database is required.

Good documentation, recordkeeping, and data management must accompany monitoring. Permanent sites used for monitoring, such as exclosures, transects, plots, and photo points, should be permanently marked with GPS-located aluminum project markers and entered into a national database. The availability of modern technology (GPS, GIS, digital photography, and computer-based data storage media) provides the BLM the opportunity to more effectively and efficiently accomplish project documentation and records management. The BLM may never recover the valuable data that has been lost or destroyed. BLM will probably not be able to digitize all the available analog data that exists in hard copy files. A deliberate effort should be made to implement data management guidelines and requirements to capture and properly archive new monitoring data. This is particularly important and necessary in today's times with the increasing emphasis by BLM management and the public on the application of good science in making BLM resource management decisions. Increasingly, BLM is being challenged in the courts concerning resource conditions on the public lands. In some cases, nongovernmental groups and individuals are collecting their own monitoring data. Having scientifically-credible monitoring data assists BLM land managers in responding to legal challenges.

An Emerging BLM-PLF Partnership: Utilizing Retirees as Volunteers

…As one example, under the broad topic of monitoring, interested retiree-volunteers could assist field offices in reading plots and transects, retaking photopoints, installing project markers at monitoring sites, replacing signs, updating records on past land treatments, and collecting metadata information for permanent plots, transects, and exclosures for input to local or national monitoring databases. Many field offices have indicated a need for additional resources to handle their monitoring workload.

Recommendations

The 2002 and 2003 Legacy Program field visits pointed out the need for a Bureau-wide commitment to long-term resource and ecological monitoring and the proper management of those data records. Permanent transects, plots, and photo points are used by most field offices for monitoring resource conditions. They should be GPS-located, marked with aluminum project markers, and entered into a national database containing monitoring metadata. Field office project records should include an inventory of exclosures, monitoring plots, photo points, and transects, and should be properly maintained, digitized, and archived. A schedule should be set up to routinely maintain plot/transect markers and exclosure fences and to read transects/plots and retake photo points. We believe that volunteers, especially retirees, could be used very effectively for monitoring and data management activities.

Guiding Questions

4. Was monitoring included in the project? If so, what type of monitoring was initiated (transects, photo points, plots)? What was the frequency of monitoring? Has monitoring continued to the present?

The Upper Rio Puerco Portion of the Rio Puerco Project – Duane Tabb

…I remember the consistency with which staff members utilized photo points and the care with which they went about documenting the progress of each project.

…All these changes put the Project in a deep hole in terms of monitoring, project maintenance, planning for future needs, and overall project management.

I remember doing Technical Procedures Reviews in the 1990’s where it was evident, maintenance was neglected, project files were neglected, often project files could not be found, institutional memory was in short supply as to the Rio Puerco Project, and District personnel had no time to even get to the field on a regular basis…

I remember reorganization efforts that caused serious damage to the project record keeping system. In the 1960’s project records were maintained by a Records Clerk who took great pride in these records and guarded them like an old mother hen guarding her chicks. Nowadays records, if kept at all are incomplete and scattered around the office rather than in a central location, poorly maintained, and virtually useless in tracking maintenance needs and accomplishments.

Special Note: I apologize for any hurt feelings my harsh words may cause. But please nobody needs to take any of this personally, from any generation of employees. The fault lies with the system and the organization not with individual employees. Also, I would add, this criticism will apply to virtually all offices of the current BLM.

Recommendations to the Field Manager

Make a serious effort at reconstituting your project files, beginning with major projects in the Rio Puerco Project area. Put in place a system to manage the files and file them in a central location for reference by the entire staff…

Project records are just short of being a major disaster in most of the BLM. These records are important to help track the life of a project from inception to abandonment. These records hold information critical to the development of annual maintenance plans, they record all expenditures to help in making the decision as to whether to maintain a project, abolish, or abandon it. Project records are essential and critical in the event of a law suit involving a major project. Project records are essential for use by newly hired professionals to both help them locate projects and become familiar with the project culture of the BLM. And finally, well maintained project records indicate a well managed construction and maintenance program that is controlled by well planned actions as opposed to actions that are somewhat willy-nilly.

San Simon Legacy program and Field Visit – Mel Shilling

Monitoring of the affects of the detention dams effects on vegetation was my responsibility. I took dozens of photographs of each of the sites. I set photo stations at several locations with the location pinpointed on aerial photos. I took successive photos from each station for several years.

Monitoring was not done on a regular schedule. Most photos were taken as opportunity allowed. Transect readings were done in the late fall, when all other transect were read. I set photo points along the main banks of the channel from the mouth of the San Simon all the way south to the Fan and some even farther south in the Cienega area. These photo stations were identified with standard aluminum cap permanent markers and located on aerial photos.

Lakeview Oregon District Field Visit – George Lea

Storage of data**-** While I was pleased to see, in some cases, data collected many years ago still available and used by current district folks in the Lakeview district, this was not the case in all instances in the district nor across BLM. There is a need for a permanent and Bureau wide standard data storage system. Administrative policies that set arbitrary age limits on what must be destroyed or sent to storage somewhere in “no-mans-land” needs to be modified to permit the routine protective storage at the district office of data particularly resource data of historic significance. This system must be applied consistently in all BLM offices so as employees transfer from location to location they find the same data storage and retrieval system in operation. I suggest that such a system be established soon and that data currently being collected be stored now and as funds become available the older data be stored in the new system.

Monitoring- This Legacy field visit reinforced my view that the Bureau needs to make a strong commitment to long-term ecological monitoring and the management to the data collected. With the pending retirement of a large percentage of BLM's work force to occur over the next few years coupled with the rapid turn over of field office personnel, the need for a Bureau wide data management system is critical. It is possible that Public Land Foundation members and other retired BLM employees could be used for collection and storage of monitoring data.

FY 2004 Report - A Legacy of Resource Monitoring

Introduction

Land managers need sound information about resource conditions and ecological trends in order to order to sustain the health, biological diversity, and productivity of the public lands. Information collected from systematic monitoring allows the BLM to determine long-term trends in resource conditions and to ensure that management practices are achieving their intended objectives. In addition, long-term monitoring of plant communities is an essential prerequisite for understanding and eventually predicting responses of vegetation communities to long-term climatic changes and short-term anthropogenic or natural disturbances. Long-term monitoring provides the information necessary to objectively review and adjust management objectives and practices.

Resource monitoring by the U. S. Grazing Service began in the 1930s. A few of those sites still exist. Range trend and condition monitoring began in earnest by the BLM on permanent plots and transects in the early 1950s. Permanent monitoring sites, including transects, plots, and photo points, are an important legacy of the public lands. For this reason, the 2004 Legacy Program focused on resource monitoring activities.

Long-term Monitoring of Resource Conditions

After three years of Legacy visits to a wide range of BLM field offices in most of the western states, we are seeing some patterns emerge. Retirees and senior employees are asking questions about the status of resource monitoring. Many of them have inquired about specific transects or plots or photo points that they initiated in the past. They want to know if these monitoring sites are still in use and what the results indicate. They are curious about how the land has changed. They have expressed concern about monitoring sites being discontinued or abandoned. Some retirees have indicated an interest in helping field offices with resource monitoring.

Increasingly, BLM is being challenged in the courts concerning resource conditions on the public lands. In some cases, nongovernmental groups and individuals are collecting their own monitoring data. As many of us learned over the years, having scientifically-credible monitoring data greatly assists BLM land managers in responding to legal challenges. Monitoring should always accompany resource management and is an essential component of adaptive management (Crossley, 1996).

The current monitoring problem is two-fold: 1) the maintenance, archival, and retrieval of records from existing permanent plots, transects, and photo points and 2) the proper selection, design, and implementation of new monitoring sites and protocols. Existing monitoring sites should be documented in the field office records, with GPS and map locations both noted, and project markers or reference posts installed and maintained. These activities are well-suited for willing retiree-volunteers. It is possible that retired BLM employees could be used as volunteers by many field offices for the field collection and database entry of monitoring data, the re-location of old monitoring sites, the installation of project markers or witness posts, or the acquisition of GPS coordinates of permanent plots and transects.

New monitoring sites should contribute data that helps to answer regional questions about land health (Bennett, 2004). Analysis of data from existing monitoring sites might also raise new management questions not anticipated at the time the sites were established. Those questions could be addressed by further analysis or synthesis of the existing data, or through the addition of different indicators and protocols at those sites. In the future, BLM must be careful about designing scientifically-sound monitoring strategies and protocols, including the choice of what indicators to monitor (Bennett, 2004).

Lessons Learned From Field Office Interviews

As part of the Legacy Program activities in 2004, 15 field offices were interviewed about their monitoring activities. The interview questions included the following:

- ✓ What types of resource monitoring, specifically those that utilize permanent sites, are conducted by the field office?
- ✓ What variables or indicators are measured?
- ✓ What is the frequency of measurement?
- ✓ When were the plots or transects established?
- ✓ How does the field office organize and schedule its monitoring workload?

Interview results were summarized as follows:

- ✓ Rangeland condition and trend plots and transects represent the longest and best-maintained monitoring data in BLM
- ✓ Many of the older condition and trend plots and transects (pre-1968) have been lost due to poor recordkeeping
- ✓ Systematic monitoring of permanent plots and transects fell off in the mid-80s in many field offices
- ✓ No permanent plots or transects have been established to monitor ecological trends in the field offices interviewed
- ✓ Only two field offices out of the 15 interviewed had formal plans or schedules for systematic monitoring
- ✓ Very few field offices have consistently used the same monitoring protocols (one exception is Las Cruces, where Parker 3-Step transects have been read consistently every 5 to 10 years since 1952). *Note: it is very important to continue using the same protocols originally established for the permanent plots/transects, although additional protocols may be added to the site.*
- ✓ The 3 x 3 or 5 x 5 photo plots re-taken every 5 years are very valuable for showing visible trends in ground cover, plant species, shrub canopy cover, etc.
- ✓ Permanent plots and transects represent a monetary investment and are an important legacy of the public lands
- ✓ Legacy participants commented favorably on the Montrose FO practice of employing an ecologist to do monitoring for the entire field office (all resources)

Permanent Monitoring Sites are Valuable Assets

Older plots, transects, and photo points are particularly valuable, even if they have not been re-measured or re-taken regularly. For example, the Pacific Northwest Research Station has conducted long-term (since 1910) measurements on a network of 145 permanent forest study plots in California, Oregon, Washington, Idaho, and Colorado. The resulting information has been invaluable in answering questions about forest ecology and management. The BLM field office in Las Cruces, New Mexico maintains a network of over 40 Parker 3-Step transect clusters established in the early 1950s to monitor rangeland condition and trend. Many of these sites have been re-measured at 5-year intervals, resulting in over 50 years of record.

The Newcastle Field Office in Wyoming recently determined that the value of a rangeland condition and trend plot, established in the 1960s and re-read periodically, was approximately $60,000. Thus, permanent monitoring sites are valuable assets and an important legacy of the public lands. These sites, and the records obtained from them, should be maintained in perpetuity.

A Strong Commitment to Long-term Monitoring is Needed

As we concluded in the Legacy 2002 Summary Report, BLM should make a strong commitment to long-term resource monitoring. With the pending retirement of a large percentage of BLM's work force occurring over the next few years (Durant, 2003), resulting in the anticipated rapid turnover of field office personnel, the need for a Bureau-wide data management system for resource monitoring is critical. BLM will be losing much of its institutional memory, including information about monitoring. The review of FLPMA completed by the National Wildlife Federation and Natural Resources Defense Council (2001) concluded that monitoring programs within BLM are inadequate and ineffective and that BLM should improve its credibility with regard to the issue of monitoring.

BLM needs a Bureau-wide database of metadata covering monitoring sites and designated research, study, and reference areas. Metadata about permanent plots, transects, photo points, and designated research and reference areas should be entered into a Bureau-wide database and made available Bureau-wide. Permanent plots, transects, and photo points represent an important public investment. Some of these sites were established in the 1950s and 1960s. A study should be conducted to determine whether existing databases, such as the Rangeland Improvements Project System (RIPS), could be modified for this purpose or if a new database is required.

Good documentation, recordkeeping, and data management must accompany monitoring (Franklin, 1989). Permanent sites used for monitoring, such as exclosures, transects, plots, and photo points, should be permanently marked with GPS-located aluminum project markers or steel reference posts and entered into a national database of permanent plot metadata. The national database should be archived in the BLM Library. The availability of modern technology (GPS, GIS, digital photography, and computer-based data storage media) provides the BLM the opportunity to more effectively and efficiently accomplish project documentation and records management. The BLM may never recover the valuable data that has been lost or destroyed. BLM will probably not be able to digitize all the available analog data that exists in hard copy files.

A serious effort should be made to implement data management guidelines and requirements to capture and properly archive new monitoring data. This is particularly important and necessary in today's times with the increasing emphasis by BLM management and the public on the application of good science in making BLM resource management decisions.

Long-term range condition and trend monitoring, such as that conducted by the Las Cruces field office using Parker 3-Step clusters since 1952, is to be commended and serves as a model for the rest of the BLM. However, traditional range condition and trend monitoring is not an adequate substitute for ecological monitoring conducted for the purpose of assessing regional ecosystem health or the ecological integrity of plant community types. Ecological monitoring should always have a peer-reviewed design and a scientifically-sound set of sampling protocols.

Recommendations

Specific recommendations for monitoring include:

1. Recognition on the part of BLM senior management that permanent, long-term monitoring sites (plots and transects) and the data derived from them are valuable public land assets.

2. Create a Bureau-wide database of metadata covering long-term monitoring sites (permanent plots and transects) and designated research, study, and reference areas.

3. Metadata on permanent plots/transects should be published and archived in a national location (e.g. the BLM library).

Guiding Questions

The following questions are used to frame the Legacy site visits and prepare the site reports. Legacy volunteers are responsible for completing the site reports. Questions 1 through 5 should be addressed prior to the field visit if possible. Questions 6 through 8 will be addressed during the close-out of each site visit.

1. What were the original objectives of the resource monitoring?
2. What were the goals or expectations in terms of utilizing the results?
3. When was the monitoring initiated?

4. What type of monitoring was initiated (e.g. transects, photo points, plots)? How are the sites marked and documented? What was the frequency of monitoring? Has monitoring continued to the present? If not, when was the last measurement?

5. Were photo points established? If so, have they been re-taken recently?

6. What is the status of the project files and where are they maintained?

7. What are your observations and conclusions based on the 2004 site visit?

8. What do you recommend to the field manager in terms of follow-up actions?

Legacy Visit to Burns District – Bill Phillips

The records I looked at were in good order. In fact, they are in the best order I have seen in the BLM.

The Photo Trend record proved to be of real value in showing change of the rangeland conditions over time.

Rangeland Trend Monitoring in Wyoming – Jim Morrison

Background of the Rangeland Trend Monitoring Program

In the mid-1960's, the range adjudication requirements of the Taylor Grazing Act were almost complete throughout the Bureau's jurisdiction. Following this, some experimental grazing management schemes for selected grazing allotments were developed. It was also at this time that Gus Hormay's Rest-Rotation Grazing System became popular with the Bureau and many offices were establishing this system as well as grazing systems in conjunction with Allotment Management Plans. This was then followed by the concept that some attempt of monitoring was needed to determine if these grazing systems and other management measures were meeting objectives.

Prior to this time the Bureau had established some monitoring at various locations, using a variety of methods. Some that come to mind were Condition and Trend Studies, that were established at permanent points throughout the Grazing Districts (as they were known then), using a transect method such as the Forest Service Parker 3-Step or similar technique. Some offices also used utilization cages and clipping-weighing studies. In the late 1960's the Bureau decided to establish a more standardized method of monitoring rangeland trend, and the Federal Service Center at Denver was given the task to initiate a method and provide the necessary training for field offices to implement the method. The Rangeland Trend method was then established, including manual instructions.

This methodology continued to be the most commonly used method of monitoring grazing management schemes, with some modifications, of most allotment management plans throughout the Bureau well into the 1980's and in some cases 1990's. Some offices still depend on some of this data and continue to monitor, at least partially, using the same basic techniques of this monitoring system. In time this method began to receive some criticism, particularly in regards to the methodology for obtaining quantitative data and became less used and depended upon in favor of other methods or of no monitoring at all in many cases due to changing Bureau priorities.

Without the benefit of having a manual for reference my memory of the basic methodology is as follows: The grazing allotment was to first be stratified to establish what was known as "key areas" for monitoring. These key areas were to be selected based as the most reliable areas judged to most reflect the changes to vegetation and soils of the grazing system and other management measures. The key area selection was based on the size and variety of vegetative communities, major soil type changes, terrain, distance from water, fences, or other factors affecting the degree of livestock use, and in some cases wildlife habitat values. The key area was judged then to be representative of a particular segment of the grazing allotment. Within each key area a location was then selected to establish range trend photo plots. These plots were to be representative of the key area. Care was taken in their selection as to include within the plot those plant species or other attributes determined to be of value for monitoring, so there was selectivity involved and were not necessarily located randomly. A permanent stake was placed for the photo point of the plot and two opposing corner stakes were permanently placed to hold a frame which was either 3x3 foot square or 5x5 foot square depending on the vegetative type. The later size was more suited to large shrub communities. In these two field office areas, the 3x3 foot plot was most commonly used as the shrub species in these areas were quite small in stature resulting in the smaller plot being quite satisfactory and easier to photograph. The 5x5 foot plots required a small stepladder in order to approach getting an aerial view photo. A 3 foot or higher permanent reference stake was placed in the vicinity of the plot so that it could be easily seen from a distance. Documentation and mapping of the monitoring site location included on a special form was recommended for ease of finding the sites in the future, particularly if the reference stakes were missing or not easily seen.

The plots were to be photographed aerially using a 35mm wide-angle camera, by standing at the photo point stake and using the frame to identify the plot borders. In the first few years of the monitoring program, the photographs were usually developed by a firm in Texas that had contracted with the Bureau to help insure consistent quality of the prints. In time field offices found other means to develop the film such as using a local drugstore for this purpose. The prints were to be 4 x 6 inches and placed in binders for easy viewing and comparing from year to year. In addition a general landscape view picture was also required, using the same photo point and landscape photo, including about 10% sky in the horizon. As a rule care was to be taken to establish the photo points to point southward in order to eliminate shadows from the photographer over the plot and landscape. It was recommended for the photos to be taken annually and at about the same date each year or as close to it as possible to avoid any seasonal changes being reflected between different years.

In addition, the system called for identifying and measuring the vegetative cover of the plants in the plot. Often seedlings or small plants were counted rather than measured individually and then the cover area of that particular species was estimated. A square foot grid with smaller divisions was used as a tool to help with the ground cover estimates. A special form was developed, and later modified for recording the results. Also a map of the vegetation by species was to be drawn on the form. The purpose of this information was intended to reflect the quantitative changes in the vegetation community, by species, both numerically by number of plants as well as vegetative cover. The amount of vegetative litter, as well as any stones or rocks greater than 2 inches in diameter, were also to be included in these measurement. A formula was printed on the form to then determine the estimated amount of vegetative cover, etc. for each species. The quantitative vegetation information was to also be gathered every year to start with or as often as thought necessary to adequately reflect changes from implanting management measures. In time the Bureau found that the in many cases the quantitative data found by using this method could not be relied upon as a true indication of the actual vegetative changes occurring. Probably the most critical deficiencies of this method lay in the small sample size and the selectivity of plot locations. Linear transect methodology has become more acceptable for determining vegetative cover and individual plant species response, at least quantitatively. As a result, many offices quit monitoring the vegetative information in these plots many years ago, some offices periodically just took the photos, and some offices abandoned this rangeland trend method all together, using a different method or non at all.

In addition to monitoring the trend plots, grazing utilization estimates were also prescribed to be taken at the key area, preferably using the reference post as a take off point. The common method for measuring grazing utilization was the Step-point method. Utilization estimates were normally done annually as soon after the close of the grazing period as possible to prevent re-growth from complicating the estimates. Often grazing utilization estimates were made on these allotments for several years even after range trend monitoring had been halted in some offices.

The information from this monitoring methodology was to be filed separately by allotment and used periodically for analysis of the implementation of the allotment management plan and a determination as to meeting the plans' objectives. A special formula was prescribed to complete this analysis and its' use had mixed results. Many managers found the analysis was not defendable and so the method was no longer used.

Field Office Visit to Pinedale, Wyoming for Review of Rangeland Trend Monitoring Program – Jim Morrison

Background and history initiating the rangeland trend monitoring system on the Desert Allotment

Two of the allotments in the Resource Area then had recently developed allotment management plans for the Bouseman Allotment and the Desert Allotment. As I had recently experienced establishing rangeland trend plots for monitoring in the Rawlins, Wyoming District from which I transferred from, and saw the need to establish monitoring to evaluate the effectiveness of the allotment management plans, we decided to initiate the monitoring that summer. We first established monitoring plots on the Bouseman Allotment located in the foothills south and east of Pinedale. We established two key areas with corresponding plots in June of 1969 on this rather small allotment. The State BLM Range Specialist at the time soon visited the allotment with us for a review and determined that at least two plots should be set up to represent each key area rather than one. This was a change in policy for me as we had only established one per key area in the Rawlins District and as recommended by the staff from the Denver Service Center who trained us there. So we immediately set up two plots near each other in the key areas and continued this practice later when we established the plots on the Desert Allotment. I think the logic was that two was better than one, particularly if one of the plots was no longer usable or could no longer be found. Also the results of the two data sources could then be compared for reliability. Since then the Bouseman Allotment has been further divided and the grazing system changed. Records indicate that photos were taken at the photo points as recent as July 15, 2003, which was the first time since 1986, and the latest vegetative readings were taken in 1985. Due to time constraints we did not visit this allotment for this review.

In July of 1969 we established the rangeland trend monitoring studies on the Desert Allotment. The allotment was a fairly large common use allotment consisting of 136,369 acres of which 95% was public land. It was a short term use allotment used by 18 cattle permittees who grazed the allotment with cattle during the months of May and June while they awaited “range-readiness” determinations for their Forest Service grazing allotments for summer use. There was also one sheep operator that grazed the allotment in the late winter and spring. In 1968 a rest-rotation grazing system had been designed and the allotment had just recently been divided into four pastures to accommodate the grazing system, requiring one pasture to be rested completely from grazing each year. The original objective of the allotment management plan was to increase the vegetative cover from an average of 40% to 60% for watershed protection. Supposedly the grazing system was not religiously followed and in time not at all. The system was changed to a deferred rotation grazing system in 1980 and in 1993, the allotment was divided into four smaller allotments basically using the previous pasture fences as allotment divisions and according to the field office staff the grazing use since then has been grazing season long (with some limited deferment) generally as it was prior to 1968.

Originally in July 1969 we identified 16 key areas on the allotment and established 32 trend plots (two at each key area) and took the photographs and conducted the vegetative readings. All of these recorded results currently remain in the files at the field office. Within a few years the monitoring of one of the plots at each key area was discontinued and assumed to be not needed. There may have been other reasons for abandoning some of the plots—for example one we visited contained a cow trail now through the plot. Many of these discontinued plots can yet be located today, as the plot stakes still remain.

Findings

In general, according to records, the plots were visited and photographed diligently through the 1970’s and then less frequently in the 1980’s, then almost no return was made to the plots since then until 1990 and 1991 when a few of the plots were revisited and photos (slides) were taken. Vegetative data was collected and measured about every three years after establishment until 1985. Since then no vegetative data has been collected.

Our field visit consisted of visiting five of the key areas and there we observed seven trend plots. All of the plots were relatively easy to find as all but one of the reference posts were still visible and with the plot location documentation in the file, little time was required in finding the plots. At each site we discussed the current findings, reviewed past photos and data of the plot, and discussed the values and shortcomings of the monitoring system. We visited the following trend plots: Sand Draw Allotment: plots 2, 6, and 7; and Alkali Draw Allotment: plots 1, 2, 3 and 4.

The following are some notes of the site specific visits:

Sand Draw Allotment, plot 6. The original cover was measured at 13.02% of which 10.22 % was vegetative cover. Our estimate now was it was about the same. At this site we also established a Daubenmire line transect and took the readings. The results compared well with the original 1969 measurements. A suggestion would be to use both methods at the same time and location and compare the results of the two methodologies. See Photos # 1, 2, and 3.

Sand Draw Allotment, plot 7 appeared to have a significant improved change both in cover and composition.

Sand Draw Allotment, plot 2: There is also an old permanent line transect plot, thought to be a Parker 3-step system or similar near the trend plot. There is a project marker stake with the following information on it: Desert Rocks Cluster No. 6, Sec 2, T29N, R108W, 1954. See Photo # 4. It would be of interest to find the data from this transect and compare it to the data of the nearby trend plot. Possibly this information was filed in what was then known as Range Condition and Trend Studies, which was a Bureau-wide effort at that time. We also found the original Plot 1 trend study nearby, which had been previously abandoned from further monitoring in the early 1970's. In comparison to previous data and photographs, a significant change in vegetative cover in the past 35 years is not apparent in this key area and the trend appears static.

Alkali Draw, plots 4 and 3 (previously abandoned and now contains a cow trail). This salt desert type appears static in vegetative cover and composition. Plot 4 had photos taken as recently as 1995. See Photo # 5. Nearby Plots 1 and 2 in a nearby sagebrush-grass vegetative type also reflected very little change throughout the 35 year monitoring period. See Photo # 6.

In addition to the trend plots demonstrating overall changes, or lack thereof in vegetation cover and species composition, other attributes were noticed such as the morphology and ages of individual plants, soil erosion characteristics, litter accumulation, desecration of animal fecal materials and plant litter. Any major changes in the overall landscape are quite apparent from the landscape-view photo. Many of the changes are subtle and not very noticeable from year to year, but often more substantial when photos and data covering many years of time are compared. Yet at other sites very little has changed in 35 years. The accompanying staff thought that most of the previously selected key areas were still valid for rangeland monitoring purposes.

A review of the records held in the office reflected that these records have been maintained in an orderly manner and readily available for use. The field office staff is commended for that.

The rangeland trend plot monitoring for the most part has been put on hold and almost totally neglected for many years. Monitoring now is limited to newly emphasized monitoring for riparian areas and the monitoring needed to determine if rangeland health standards and guidelines are being met, of which the Daubenmire transect method is used. Also, I understand some grazing utilization monitoring still occurs using the step-point method. Managerial priorities have seemed to not only deemphasize the need to monitor the long-term influences of grazing management on the rangelands, but the emphasis on grazing management also seems to now be less important. According to interviews with the staff, very few grazing permittees are following any sort of grazing management scheme other than season-long grazing or limited grazing deferment. (I define "grazing season-long" as grazing occurring throughout the entire allotment during the allotted grazing period year after year with no prescribed alterations or periods of rest from grazing during that period). Additionally, according to the staff, compliance concerning grazing permit terms has not been a high priority in recent years.

Recently a permittee monitoring program has been initiated in the Pinedale Field Office area. From what I understand this program is voluntary, but the BLM identifies the methodology and the terms of monitoring are agreed upon by the BLM and the permittee. The permittees do the monitoring and keep the records in an agreed upon matter with BLM. This gives the permittee more ownership of their grazing management on the allotment and a better understanding of the objectives for the rangeland resources that both BLM and the permittee are striving for. BLM provides the necessary training and oversight needed for this program. The degree of technical skills used in this monitoring may vary on a case by case situation, depending on the permittee's abilities. In many cases, it is planned to use the rangeland trend monitoring key areas and plots for this effort.

From discussions with the staff, there appears to be a lack of adequate reference points identified of locations to observe where no livestock grazing has ever occurred or has not occurred for many years, such as relict areas and fenced exclosures. These areas are invaluable to help determine site potentials and compare current grazing influences to the vegetation and soils to a non grazing situation. I understand that even the wildlife habitat exclosures built during the 1950's and 1960's have since been removed in the area.

Understandably some of the original grazing systems designed in the past were experimental and some no doubt failed to either meet management objectives or were considered too difficult to follow by the permittees. The question remains, however, if season long grazing, or some modification thereof is beneficial or not in meeting rangeland health standards and other resource objectives for any given area. However, a review of these concerns, were not the focus of my visit.

Recommendations

The following recommendations are given regarding the future use of the rangeland trend monitoring originally established in the late 1960's.

1. A concerted effort should be made to locate, photograph, and observe the vegetative and surface conditions in all plots (including those previously abandoned because of duplication at key areas) and make a determination if the plot and its' location is still valid for representing the specific area of the allotment in regards to grazing management.

2. For those trend plots identified to be still valid and appropriate for continuing rangeland trend monitoring, a comparison should be done in recording the vegetative cover within the plot frame area as compared to information gathered from a Daubenmire transect taken nearby in the same key area. If an analysis of the comparison demonstrates a fairly close parallel in the results, then a long-term trend analysis of the key area using the gathered vegetative cover data from previous years and the recent information should be attempted. In any case it is recommended to establish a permanent transect at each of these locations for use of the Daubenmire or similar line transect method for future monitoring.

3. For future monitoring I recommend that photographs of the plots, including the landscape view, be taken at least once every three years or more often if there has been a grazing management change or some other reason such as the occurrence of fire, change in class of livestock, or some other factor that may significantly change impacts to the rangeland. Vegetative cover should then also be measured and recorded at these times preferably using line transects methodology.

4. An analysis should then be made from this monitoring data as well as other monitoring data collected for each allotment in relationship to rangeland health standards, and a determination then be made of any further management actions needed.

5. Continue to file the monitoring information in an easy to find and easy to use manner. Maintain the photographs in a consistent manner in quality and size for comparison purposes. Any slides should be converted to prints. Prints can be scanned and stored electronically if need be, as well as all monitoring information.

6. In appropriate situations, accommodate the permittee monitoring system with the continued use of the rangeland trend monitoring sites and methodology in addition to other monitoring that may be applicable. Care would need to be taken to ensure that the photography techniques and any quantitative measurements will be acceptable to BLM and would require specific training and oversight.

Other Concerns

Changing management philosophies, ideologies and program emphasis, appears to take away from the basic need for on-the-ground management, including rangeland monitoring. Although this has always been an obstacle from achieving the Bureau's primary role, it appears to be more apparent than ever at this time. From discussions with the staff, I am left with the impression that management emphasis is currently limited to maintaining "status quo", so to speak, in regards to vegetation cover, particularly on sites that are not riparian or where some other resource value is not threatened by grazing activities. I assume that this is all within the framework of ensuring standards for "rangeland health" will be met. That being the case, it surfaces the question, does BLM have the stewardship responsibility of these public owned land to also improve the environment in addition to maintaining it, where the opportunity presents itself ?"

I see an irony about the recent accelerated gas field development over the landscape in the Desert Allotment and elsewhere. The "overnight" changes allowed to the surface environment from this activity seem so dramatic as compared to the much more subtle changes that normally occur from livestock grazing influences particularly in an arid environment such as this. I'm sure this is evident by the public and the public land users, including the ranchers.

At a time when the range livestock industry is undergoing continuing challenges and review of the legitimacy of the grazing of public lands, it seems inappropriate not to place range management and monitoring as a high priority. The lack of adequate and dependable information will only sustain the issue in political quagmire rather than factual demonstration.

Field Visit to Rawlins, Wyoming for Review of Rangeland Trend Monitoring Program– Jim Morrison

Background, history, and review of the rangeland trend monitoring system on the Standard Allotment.

As I recall, I developed the allotment management plan for the Standard Allotment during the winter and spring of 1968. Following this I established monitoring that grazing season using the rangeland trend monitoring system. During the summer of 1967 I had received training in establishing and maintaining this monitoring system. The Standard Allotment is a rather small allotment containing about 13,000 acres in which 87.4% is public land. Traditionally and at the time the plan was developed the allotment was used by a band of sheep in early spring and late spring by 500 cattle. Since 1990 there has no longer been any grazing by sheep and in recent years the allotment has only received light grazing use by cattle. The original management plan prescribed a deferred-rotation grazing system, and was divided by fencing into three pastures. Several additional livestock water sources were added to improve grazing distribution. In addition starting that first season a total of 8700 acres on the allotment were treated chemically for sagebrush control. The original objective for the plan was to increase the amount of cover for watershed protection and increase the proportion of grass species for livestock forage.

In 1978 the management plan was revised based from monitoring data and concerns by the Bureau and the permittee. Vegetative cover measurements in 1968 averaged 24.18% (litter not included) and showed an increase to 26.21% in 1974. Then in 1978 the measurements identified a decrease of 12.62% showing a decrease in ground cover of almost one half. In 1977 the methodology for measuring vegetative cover was changed to comply with the Wyoming Integrated Study Procedure, recommending 100 point pace transects methodology. I did not review the actual analysis data from the monitoring to know if any of this difference in 1978 was subject to different measuring methods or that a correlation had been found with the previous measurements in 1968 and 1974. Regardless, a revised plan was developed with hopes of increasing the key forage species from 20% to 35-40% and to increase the ground cover (vegetation and litter) from 15-20% to 30% or more, for watershed protection. In addition it was determined that at least 15% of the vegetation cover needed to remain as sagebrush to help maintain habitat for pronghorn, mule deer, and sage grouse. A few years earlier, 1000 yearling cattle were authorized to graze the allotment in place of the traditional use made by 500 mature cows. That extra grazing use in combination with some below normal precipitation years was thought to be the primary cause of the reduced vegetative cover. The new plan called for a return to the 500 cattle along with the sheep use in the spring, and again in the fall and winter months. In addition a full rest-rotation grazing system was to be applied. Since 1990 the sheep AUMs have been put into suspension until monitoring reveals that there is adequate forage to sustain that amount of use or to convert that amount of use for additional cattle grazing. The authorized use since then on the allotment has been for 500 cattle for the months of May and June.

In 1968 there were 14 rangeland trend monitoring plots established representing that amount of key areas. A special effort was made to locate key areas in and out of planned sagebrush control areas, therefore requiring more trend monitoring sites than would be normally be expected for that amount of acreage. After the plots were established, photos were taken most every year until 1980 and then again in 1989 and 1993. No photos had been taken since then. Vegetation cover was measured after 1968 in 1974, 1977, 1978, and 1980 (this being the last year of recorded measurements). As mentioned before the readings done in 1968-1978 were used for analysis and modification of grazing management.

Findings for the Standard Allotment

…The monitoring records for all three allotments visited were filed in the office in binders, including all photos and documentation of the monitoring results gathered. All the photographs for each plot were filed in a packet pocket and had to be taken out and spread out in order to compare from one year to another. The field office staff is commended on their effort in maintaining the files in relative good order.

Background, history and review of the rangeland monitoring system on the Platte River Allotment and the Sulphur Springs Allotment.

A combined Allotment Management Plan was developed in 1967 for both the Platte River and Sulphur Springs Allotments. In the summer of 1968, I was assigned to establish rangeland trend monitoring for both allotments. I established one trend plot at each of 9 key areas on the Platte River Allotment and on 13 key areas on the Sulphur Springs Allotment. Photos were taken of the plots and vegetative-ground cover measurements were taken at all monitoring sites. Photos were then taken annually on both allotments for most of the following years until 1989, and then not again until 2002 and 2003. Follow-up vegetative and ground cover measurements were conducted again in 1972, and again in 1988 and 1989, and were used for evaluation purposes in determining allotment management plan modifications in both 1972 and 1990 for both allotments. Photos, and measurements using a line transect method have been taken now in 2004 for both allotments. Another evaluation and plan revision now is planned. There remains a concern that vegetative cover and composition goals are not being met for these allotments.

Overall findings

The rangeland trend monitoring program initially established in the 1960's in the Rawlins Field Office, has been useful in recording, both through photographs and documentation, the dynamics of various vegetative communities at site specific locations. As evidenced in plan modification processes, the information has been useful in determining success or failure of implementation of management measures and in determining courses of action to take in future management, through analysis of the information. On the other hand, experience has shown that some of the monitoring sites or key areas may not have been located in an area that best reflects an example of the actual livestock grazing influence that a given area of the allotment receives. For example, many of the previously identified key areas are no longer used for annual grazing utilization monitoring by the staff because of this, and in some instances such as in riparian areas, additional monitoring sites, using different methodology has been established. In addition, the vegetative and ground cover measurements previously taken within the trend plot using the original prescribed methodology have long been suspect in relating to a valid example for the specific area, and other methodologies are now more acceptable. The field office, however, continues to use the plot sites for photo comparison purposes and also to review the previous quantitative information in an attempt to understand the historic trend of the vegetative communities. Attempts are made to incorporate this information for management assessments, even though new techniques and new resource concerns have also emerged in time.

The field office staff indicated there are limited locations that demonstrating vegetative communities not being influenced or recently influenced by livestock grazing, such as relict areas and fenced exclosures, but they do use these sites when the opportunity presents itself in an attempt to predict vegetative site potentials.

Bureau management priorities are now more focused on monitoring in relationship to meeting the Rangeland Standards and Guidelines developed in the late 1990's, riparian area assessments and condition monitoring, and monitoring for specific wildlife habitat concerns. However, rangeland trend monitoring efforts can be correlated in assisting to help evaluate conditions for these newer priorities in some cases, even though there has been a reduced emphasis in obtaining rangeland trend information. Although there has been a large gap in the recording of the year to year dynamics that was the common focus of the rangeland trend monitoring effort, recently there has been an awareness to again review this information on some allotments, and to even continue the observation and photographing procedures, at least, of this monitoring system. At some of the trend plot sites, line transect measurements continue to be conducted, to obtain the quantitative information.

Recommendations and Concerns

1. For those allotments where rangeland trend monitoring has been established, a diligent effort should be made to evaluate the information and relate it to the current needs. In situations where the existing trend plots appear to be representative and useful for continued monitoring purposes, the photos and vegetation/ground cover measurements (using a line transect method) should be continued. The photos and cover measurements should be taken at least every three years or more often if a management

change has occurred, or other reasons such as a wildfires, or similar actions that may cause a rapid change to the vegetative dynamics of the site.

2. Rangeland trend monitoring information, rather old or current, should be evaluated in conjunction with all other rangeland concerns and values when determining future management actions. Attempts need to be made to draw some conclusions using this information as to what has happened in the past and what may happen in the future, using varying alternatives. In many cases trend plot information has revealed a static or downward trend since 1968. This information is invaluable in determining future management needs, direction, and priorities.

3. Specifically, the trend monitoring information gathered on the Standard Allotment needs to be re-evaluated and comparisons made as to the grazing history to determine what specific changes to the vegetative community has occurred and why. Observations and review of the data indicated a dramatic change has occurred, but not toward meeting original objectives. A leading question arises as to what influence did the sheep grazing contribute in the past?

4. Re-examine those trend plot locations that appear to receive very little livestock grazing influence to evaluate their further value for monitoring and abandon those no longer useful. Additional new trend plots may then need to be established in some cases if a portion of the allotment is not adequately represented for trend monitoring. In areas where the trend plots are located in key areas and are still determined to be valid sites representative of the livestock grazing influences, grazing utilization monitoring should continue be conducted at these sites in order to correlate the influences to vegetative trend. Since none of the original key areas were established in riparian areas, monitoring for those purposes will also have to be done.

5. Efforts should be made to incorporate the trend photos and other recorded data into electronic files for easier and more flexible use in the future. The accumulative volume of photos, in particular, for each plot site makes viewing comparisons very difficult.

6. Attributes, particularly of the trend photos, that should be evaluated in addition to the specific vegetation/ground cover changes that the photos often reveal are changes to the soil surface characteristics, plant age and morphology, desecration time patterns of plant litter and animal fecal materials, and other attributes that may be illustrated in the landscape photo such as a nearby wildfire occurrence, etc. An example of the latter is a landscape photo of plot 4 in Pasture 2 of the Sulphur Springs allotment which illustrates on the horizon a wildfire that occurred within a month of taking the original photo in 1968. With this photo some of the vegetative succession changes can then be observed, although from a long-distance, throughout the past 36 years. Another example are snow cap deviations between years where mountain ranges show up in the background photos, giving some indications of the snow moisture relationships that may have had an influence on the site, particularly on the higher elevations areas.

Red Rock Lake Wetland Project, Mount Dome Planning Unit

Alturas Field Office, Alturas, California – Kata Bulinski

MONITORING and FILE MAINTENANCE

I have chosen to expand the review of my Legacy Project from the Red Rock Lake Wetlands Project, and to discuss monitoring for additional interrelated “projects” in the Red Rock Lakes area, Mount Dome Planning Unit, including Range Condition and Trend Transects, Wildlife Monitoring Transects, Wildlife Browse Transects, Wildlife Guzzlers, Wheatgrass Seedings, and the Red Rock Wild Horse Herd Management Plan. I will therefore discuss each project, with specific remarks on objectives, monitoring, file management, and current observations / conclusions. For several of the projects, not all guiding questions will be answered, as information was not available.

Red Rock Lake Wetland Project

Monitoring of the Red Rock Lake Wetland Project consisted of several project inspections and maintenance in the first few years only, such as relocation of goose nesting platforms in 1977 during a drought. . The contract inspector’s log for the construction of the fence is in the project file, but no photos from 1976 are in the file.

No photo points were formally established, although, due to accessibility, a number of sites could be identified easily for repeatable photographing. Monitoring began with construction photos during the summer of 1976. However, none of these photos are currently in the project file.

Some regular monitoring, even once in every two years, would help to assess wildlife and wild horse herd use of the lake and its surrounding area.

Range Condition and Trend

Both Ericson AMPs called for monitoring every three years, using pace frequency transect method (used in the early 1970's) or basal cover or Parker Loop index. Objectives and methods for the Ericson AMPs included the following:

-improve livestock distribution by developing/reconstructing water improvements and fence

-increasing available forage by juniper removal and seeding to grasses and legumes

-maintain or reduce sheet erosion by maintaining ground cover

-maintaining or improving wild horse habitat and forage, by seeding and juniper removal

I remember having seen monitoring records dating from the 1950's; rebar posts were installed to mark transects and photo points. The Daubenmire transects or step point transects were read faithfully every year, often on the same date (or nearly so) each year. I believe there were records of the transects and photo points in the Redding District, Siskiyou Resource Area, but that these records were lost in the transfer of administration from the Redding District to the Alturas Field Office.

Some monitoring records from transects read in the late 1970's to 1982 were retained in separate monitoring notebooks, in a separate file cabinet rather than in the actual grazing case files. For these, the protocols are vague, and photo points, if established, were not well documented in many cases. However, photographs did indicate a general representational snapshot of vegetation on a particular date.

Current direction in the Alturas Field Office is to use an easily repeatable methodology based on the parameters of the interagency standard. Mark Lowrey, the Rangeland Management Specialist for this area, has adopted a 50-meter transect with photo plot. This method is consistent with guidance in the Interagency Technical Reference 1996, entitled "Utilization Studies and Residual Measurements, developed by the Cooperative Extension Service, U.S. Department of Agriculture, Forest Service and National Resource Conservation Service, as well as the USDI Bureau of Land Management.

Mark has located several transects which were established in the Mount Dome area in the 1970's or earlier, and has established new transects, including one to assess changes in native (relict) vegetation and one in a wheatgrass seeding. Above all, Mark stresses that a monitoring method must have consistency, repeatability, and simplicity. This last attribute is of critical importance, given BLM's staffing limitations and turnover in personnel in the next 5-10 years as our aging workforce retires.

Wildlife Browse Transects

Former Siskiyou Resource Area Manager, Jan Milller, and I remember numerous wildlife browse transects (for antelope and mule deer) in the Red Rock Lakes and Big Tablelands areas being read every year during the period of 1976-1981 by the BLM Wildlife Biologist at the time, Jeff Mattison. The fenceposts and rebar posts for these transects are still present in the Mount Dome area.

I could not locate any monitoring records for wildlife browse transect in the Alturas Field Office, nor could I find habitat management plans for pronghorn antelope in the Red Rock Lakes-Tablelands areas. It seems likely to Jan and me that the former Redding District Wildlife Biologist retained these files at his own desk, choosing not to file them in the Redding District central files; in any case, these files were not transferred to the Alturas Field Office.

Wildlife Guzzlers

Project files still exist; the guzzlers were installed in 1977 using special "drought funding." No photo points were established, although file photos show several guzzlers being installed. (See photos of guzzlers in 1977 and 2004, attached to this report.) Our team examined one guzzler which is located in T. 47 N., Range 2 E., Section 34: SE ¼ NW ¼.

There is little evidence of monitoring past about 1982, and no evidence of maintenance on project (see photos). Probably none of the guzzlers are functional today.

Wheatgrass Seedings

BLM range technicians conducted monitoring for several years, but again, there is little evidence of monitoring past 1982. No photopoints were established. There is no notation in the file of further mechanical or herbicide treatment past about 1978.

GENERAL CONCLUSIONS

I believe that BLM resource specialists in times past were no less dedicated to their work than the professional staff we have today.

Typically in the 1950's, the Daubenmire transects or step-point transects were read faithfully every year. For most of these projects, photo points were not established, or if they were, the records were lost, along with the early monitoring records (1950-1970's).

In the 1970's, BLM they read the transects and at least performed some field reconnaissance of projects such as the Red Rock Lake Wetland Project, the wildlife guzzlers, exclosures, seedings, and more formal monitoring of range condition and trend. The individuals performed monitoring to the standard of the time.

In the mid to late 1970's, BLM staffs across the West began to mushroom with "ologists," due to legal requirements for NEPA documentation and Land Use Planning (mandated by the Federal Land Policy and Management Act). Therefore, hosts of wildlife and fisheries biologists, hydrologists, soil scientists, outdoor recreation specialists, and archaeologists, sociologists, landscape architects, and a host of other resource specialists joined an agency which had been staffed mainly with range conservationists, foresters, and a few mining engineers or geologists. In the Redding District, Siskiyou Resource Area, the staff grew rapidly from three to about five or six, and the District staff from about fifteen to thirty. Duties and priorities changed rapidly during this period.

In 1982, the reorganization of BLM Northern California resulted in the Redding District discontinued and staff dispersed, and the Mount Dome Planning Unit was transferred to the Alturas Field Office. Thus a different staff acquired an additional responsibility, including lands and resources with which they were not familiar. As these were not the ones who constructed project, so perhaps a lack of ownership and background knowledge. In addition, it must be pointed out that staff has continued to be stretched thinner across the acres due to multi-resource team efforts and diminishing staff and resources.

Over time, different monitoring strategies were developed and used by range conservationists. However, funding limitations, personnel and staffing changes, management direction on priorities, and transfer of administration from one unit to another have all been contributing factors to the lack of commitment to monitoring over the long term.

In the case of the Alturas Field Office, the new Resource Management Plan may afford a chance to reexamine what we as an agency may want to do differently in future management of our public lands.

A few points to consider/opportunities for future decision making (perhaps within the RMP process) are:

- Some regular monitoring, even once in every two years, would help to assess wildlife and wild horse herd use of the lake and its surrounding area.

- What opportunities exist for local groups/volunteers to adopt the maintenance or monitoring of a project in the Mount Dome Planning Area?

Back on the Job After 52 Years--Report of a Legacy Visit to Las Cruces - Buster Riley

We visited and recorded 2004 data on NM District 3 Cluster No. 1, Transect No. 1, established by myself, Morria A. Trogstad, and Virgil A. Pate in May, 1952. I believe this was the first Parker Three-Step Transect set out in New Mexico and possibly the first in the Bureau. I will give you the exact date the transect was set out if you want to run a little contest in the Monitor to determine when other Districts established their Cluster No. 1.

The Las Cruces District is maintaining the records and continues to monitor the transects periodically. Joe Navarro (middle in photo), one of the Legacy Team members and a Roswell District employee, wrote his Masters Thesis at NMSU based on data in these transect files. The fourth Legacy team member was Dr. Dee Galt (left in photo), a retired SCS employee and BLM Volunteer. All Las Cruces District Managers and their Range Staff should be commended for this record.

FY 2005 - A Legacy of Land Use Planning

Plan Monitoring and Adaptive Management

Jim Turner: *How do you deal with adaptive management in an RMP? Appendix A in the original document (Monument RMP) did a good job in laying out a monitoring framework, decisions, techniques, unit of measure, etc. The monitoring plan also specified thresholds that, if exceeded, would trigger a revision of the plan. The only problem was that it wasn't done. Had this been executed what would the plan look like today? Is this a model you want to follow?*

Bill Baker: *It takes monitoring to assess the success of a plan and we never seem to have the time for that.*

Andy Payne*: It's great, except we're going to change and amend the plan, because we aren't going to have enough time to amend them. Revision means amendment.*

Bill Baker*: These guys didn't find anything to force the revision to occur.*

Jim Turner: *The Agency is still struggling with monitoring. What you said in Appendix A is this is what we're going to monitor, this is how we intend to do it, and if appears that results are not going to meet specified criteria then we'll do something about it. We should have 25 years of information to rely on. Think about this… When the next RMP is written, and once decisions are made, how are you going to monitor it and implement it?*

John Kurtz: *You write a follow up monitor plan so you know when to make changes to meet objectives.*

Erv Cowley: *I think a lot was done but the monitoring was not tied back to the plan. We did an amendment six months after the plan but no comments were documented.*

Jim Turner: *With the monitoring and evaluation plan (Appendix A), do you feel that you had an adequate adaptive managment strategy in place?*

Erv Cowley: *We tried to give ourselves space. This was a conscious effort not to paint ourselves into a corner that requires us to amend unless something in the plan was wrong.*

Jim Turner: *You focus on objectives, if we start deviating at this threshold we need to change the course of the plan.*

Gary Wyke*: You guys were innovative.*

Erv Cowley: *One of the dangers of developing those long term objectives is that when science changes, you end up with new terminology. And knowledge and science changes, so we don't know how to handle the change of condition class to some succession change, etc. to whatever your desired result is. We change terminology and it doesn't end up working. How do you describe a condition when it changes in 20 years?*

Bill Baker*: It's a big effort to try to explain the difference of terminology changes. How can you do the best you can in later planning efforts unless you write it in your monitoring?*

Jim Turner: *How do you know if you're achieving those planning objectives? How will you monitor it and how do we know over time if the plan is working? I think this will become extremely critical.*

Bill Baker*: The Director must make it a 5 year priority.*

Andy Payne: *Measuring is a way to get there and the plan is telling us what the end will look like. In the plan we set up a monitoring plan that probably won't happen. Do we need to say specifically what will happen or just be in general terms?*

Bill Baker: *We never changed our condition ratings to Congress in 20 years, because nobody has upgraded the table (Appendix A from Monument RMP).*

Andy Payne*: The general public is lost because of the condition classes; the terms we throw out there confuses the people.*

Bill Baker*: I proposed a monitoring person to try to manage the temporary employees and staff and a whole mind set change to manage the monitoring. If we had this person, we could manage the monitoring that is occurring. It's a real commitment. We need a priority from higher above for this.*

Paul Oakes: *In 1985 we had a monitoring report for the public and it told a story of how we were progressing with schedules and graphs to make it visual, with three times the staff and less acres and managers have to make it become a reality to get it done. Or don't say you're going to do it.*

John Kurtz: *If you're not going to monitor it, then don't set an objective.*

Erv Cowley: *There is a requirement in the handbook.*

Paul Oakes: *Design your monitoring plans as you go, in conjunction with other activities.*

Andy Payne*: We do a lot of monitoring but it doesn't get recorded.*

Paul Oakes: *We need to get this useful information into a format useable to all.*

John Kurtz: *But are we monitoring what we're supposed to be monitoring?*

Jim Turner: *Monitoring is just the start of gathering information for adaptive management. What are you going to do with the information that you collect? We need a feedback loop to keep this going. We have to consider how we can make the feedback active and viable.*

Erv Cowley: *One of the monitoring aspects is monitoring sagebrush while monitoring sage grouse, which triggers a review not an action. There is a limit to how much you can get done in the field. You have to delegate a certain person for a particular job because people are going in so many directions. We need someone tracking monitoring. What vegetation was on the Little Wood River? Terry Rich tediously transferred low elevation photographs from a helicopter and put it on a 1:24000 quad setting in a file somewhere; we didn't know it was there.*

Dan Patten: *We don't know where to look or what to look for!*

Bill Baker: *Part of legacy tour is to show where the old stuff is.*

Erv Cowley: *If it isn't statistically reliant, it's not of much value. A lot of new people coming in say if they can't analyze it statistically then it should be thrown out.*

Rob Hellie: *What we don't have from the plan – they had an adaptive management plan in it but what they set up was a process for scientific research so they had an annual review of the monitoring data. Does it have impact, repercussions, etc and where do we go? What is lacking is a process.*

Erv Cowley: *The only way to get it done is if someone can say drop something else and do this.*

Recommendations:

6. Following the completion of a land use plan, a monitoring position should be established to evaluate the success of plan implementation efforts. The position should be a full time assignment and should be specifically focused on designing monitoring protocols, evaluating results, and recommending adaptive management strategies.

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E: Monitoring Opportunities Identified at Legacy Workshop

AIM-related Issues and Recommendations

1. Issue: Because of the importance of AIM information, it is critical that adequate technology and personnel resources be committed to collecting, analyzing, and safeguarding this information.

***Recommendation**: AIM protocols should use the best, most affordable technology to assist in effectively processing information. Qualified personnel should be shared among field offices to improve the efficiency of data collection activities. All AIM data (including past projects) should be made readily available to stakeholders. Supervisor, manager, and state director accountability should be established through EPAP performance elements.*

2. Issue: The Bureau should be very cautious about standardizing and adopting new AIM methodologies without considering past data collection activities.

***Recommendation**: As new methodologies and techniques become available, the BLM needs to evaluate and safeguard older methods and sites for measuring trend. Because of the potential value of legacy data associated with these older sites, every attempt should be made to integrate old and new methods so that the continuity of legacy data can be preserved. The BLM needs to establish a team to evaluate new techniques and methods for researching and standardizing AIM methods (e.g., Floyd Kinsinger and other in the WO from 1963 to 1969).*

3. Issue: The BLM needs to improve its management of AIM records. Paper records are deteriorating and are essentially unavailable to the public. Digital records are not standardized, generally lack organization, and are also difficult to access. Because of these deficiencies, communicating the concepts of "rangeland health" to the general public is made much more difficult.

***Recommendation**: The BLM needs to focus additional resources on records management, especially the management of AIM-related information. Specifically, the group recommends reviewing record schedules, developing criteria for records retention, and issuance of workable policy and guidance to the field. Records not retained by the agency should be archived by the Public Lands Foundation or NARA (if they represent critical aspects of the Bureau's history).*

4. Issue: Evolving AIM processes may be too complex, *costly, and time consuming* for employees to implement effectively. Bureau managers must ensure that standardized processes be simple enough for employees to execute and, at the same time, transparent enough for the public at large to understand. The agency must not repeat expensive assessment, inventory, and monitoring mistakes made in the past.

***Recommendation:** Base future AIM processes on the best available science and keep protocols as simple as possible. Don't make the mistake of buying equipment that is beyond the capability of employees to operate. Review past efforts and use the lessons learned – not all past efforts were mistakes – build on the past good efforts. Also, if an office needs only a limited set of data with which to make a decision, don't require field staff to implement a extensive process of data collection which will result in wasted time and effort.*

5. Issue: Every time the Bureau reorganizes, AIM records are put at risk. Reorganizations typically create a variety of problems, including the loss of irreplaceable information. It seems that the agency is constantly starting over without properly utilizing previously collected information.

***Recommendation:** Carefully evaluate potential impacts on records (especially long term inventory and monitoring information) before any reorganization is approved and effectively mitigate all record impacts.*

Effective Bureau policy is absolutely necessary to avoid these problems and managers should be held accountable through performance requirements.

6. Issue: The BLM has established a number of exclosures across the west. Many of these exclosures have fallen into disrepair or their locations have been "lost." Because of the very high value of these exclosures, the Agency must do more to protect its investment.

***Recommendation**: Exclosures on the public lands need to be inventoried, assessed, and restored where necessary. The location of all exclosures needs to be identified and a determination of their value for continued monitoring needs to be made. There also needs to be a national effort to document current conditions, track the 'health' of exclosures, and make the derived information readily accessible to stakeholders. This would be an excellent graduate student thesis opportunity.*

7. Issue: The results of monitoring are not always used to enforce regulations. If monitoring activities indicate that a management problem exists, the managers must enforce regulations instead of ignoring negative impacts that have been identified through the monitoring process.

***Recommendation**: Evaluate what monitoring is telling you before taking immediate action. However, when monitoring indicates that a problem exists, management action must be prompt and sufficient to correct the problem. Regulations should be enforced to ensure that the health of the land is maintained.*

The BLM should develop a comprehensive approach to monitoring. All too often, the shortsighted view is restricted to livestock monitoring. The BLM should look beyond livestock and integrate a monitoring approach that considers the impact of multiple uses (e.g., OHV, wildlife, wild horse and burro, mountain bikers, etc.)

Instead of requiring resource area offices to do the preponderance of the monitoring, the resource areas should focus on use authorizations and compliance. District offices should focus on ecosystem/watershed/healthy lands types of monitoring. All too often, the BLM confuses the issue of what are we monitoring for.

8. Issue: AIM is a labor intensive process. With anticipated budget shortfalls, volunteers constitute a potentially valuable resource for augmenting AIM data collection efforts on-the-ground in the short term. . However, volunteers want to be assured that their contribution makes a difference.

***Recommendation**: Ensure that time contributed by volunteers is used effectively and that the results of their efforts are used to shape land management activities. Experienced volunteers could be used to mentor and train summer temporary employees for AIM activities.*

9. Issue: Collecting AIM information on the ground is a costly and time-consuming process. Remotely sensed data could be used to reduce this cost and expedite delivery of information to the decision-maker.

***Recommendation**: As the result of recent advances in sensors and aerial platforms, the use of remotely-sensed data could significantly reduce AIM data collection costs. Where appropriate, the BLM should develop and employ more low-level air to ground monitoring of vegetation and grazing animals. Also, the BLM should use digital elevation models to identify critical landscape conditions. The agency should also develop some sort of integrated landscape inventory and analysis data base identifying setting (landform, climate, slope, aspect) on all previous project and monitoring locations.*

10. Issue: Much of the data collected by past AIM initiatives is not available to agency specialists, managers, or the public. Often, the BLM can't find the data, doesn't know it exists, or if it does exist, where the date is stored (if it is even stored any longer).

Recommendation: *Historic AIM data should be inventoried, organized, and distributed to the public via the world-wide web. One person in each field office should be given the responsibility for managing AIM information. It is critical that these employees be provided with adequate skills and training to ensure effective records management. The PLF has volunteered to archive important AIM material that BLM is going to throw away.*

Related Issues and Recommendations

1. Issue: In the past, the BLM paid for research studies but did not receive adequate (or any) products. The group felt that the Bureau must be much more effective in managing agreements and contracts.

Recommendation: *Intensively manage research projects and cancel funding for projects that are not meeting their objectives. Regional science coordinators should carefully review University agreements and contracts for viability. The agency must control the research agenda and establish priorities to meet its internal land management needs.*

2. Issue: Bureau employees do not appear to be publishing extensively in professional journals. The group was concerned that there is little encouragement from managers to foster professional development. BLM employees in the field should be the key in developing and documenting practical information and solutions.

***Recommendation**: Managers must implement incentives to encourage their employees to write articles and publish them in professional journals. Examples of incentives include (but are not limited to) the following: 1) Provide writer-editor support; 2) Manage workload to allow time to write; 3) Pay for advanced education; and, 4) Encourage attendance at professional meetings. Articles should pertain to research involving actual field results and should also identify additional research needs.*

3. Issue: Managers and staff are dealing with an unprecedented level of complexity in managing the public lands. Often, these individuals are not given the tools, time, or funds to effectively manage in this environment.

***Recommendation**: Assess the magnitude of the issue and develop effective management strategies and techniques to help employees deals with complex issues. Institute the training necessary to make this happen!! Managers need to get involved with specialists in the field on complex issues. Advances in communication technology (e.g., Blackberry) provides the opportunity for managers to be in the field more and still conduct office business.*

4. Issue: The BLM is constantly engaged in many worthwhile activities and projects that have been demonstrated to improve the overall health of the land. The BLM public affairs organization does not appear to be effectively communicating agency success to the general public. This may result from over control at headquarters (WO) as to when local offices can "toot their horn" and what they can say.

Recommendation: *Launch a public affairs initiative to more effectively communicate "good" public land news to the public. Emphasis should be placed on before and after conditions associated with specific sites highlighting actual field success stories. Public affairs staff accountability should be established through EPAP performance requirements.*

5. Issue: The ten-year permit is mainly for the benefit of the permit holder to be used as collateral for operational financing. While it may have some value as a timing benchmark for evaluating the health of an allotment, evaluations should be an ongoing process using AIM procedures. Adjustments should be based on AIM and done when needed – not on a set 10 year cycle. The current requirement to issue 10-year grazing permits puts undue pressure on resource specialists to process the permits. The term of the permits also reduce the flexibility needed to make adjustments.

***Recommendation**: After carefully reviewing the environmental, social, and economic impacts, propose changes to the grazing regulations to eliminate the 10-year grazing permit or assure that there is adequate protection of the soil, vegetation, and water built into the conditions of the permit*.

6. Issue: The Bureau must have better support from Departmental solicitors and needs to develop a cadre of well qualified expert witnesses.

***Recommendation**: Current training opportunities for resource specialists to become effective expert witnesses should be reviewed and additional training should be developed if necessary. The National Training Center should develop and distribute training materials to assist employees with preparing for hearings (Lead Range Management Specialists should be targeted initially). Employees called to testify should also be coached specifically for the case being adjudicated prior to the hearing.*

7. Issue: The group perceives a fundamental problem with employee morale in the Agency. In some cases, staff specialists have suffered personal legal attacks and many employees are not deriving an adequate level of job satisfaction.

***Recommendation**: Top-level managers must support their employees and provide opportunities to improve job satisfaction. Opportunities could include more technical training, encouraging participation in professional societies, and allowing employees to have sufficient longevity in a position to learn the assigned job. Managers also need to spend more time in the field dealing with complex and difficult cases.*

8. Issue: Data collection by contractors' siphons off dollars that could be directed to hiring students, who are in a natural resource track in college, to do the work. A contractor's first and foremost objective is to make a profit. Producing a usable product is secondary. While contract gathered data may be satisfactory, the Bureau's investment ends there. With student workers, the investment continues to pay off by producing a potential cadre of trained, evaluated, and motivated workers who can feed into the full time work force upon graduation.

***Recommendation**: Summer temporaries are the key to developing a future BLM workforce and to augmenting condition and trend monitoring. Policy changes should be made to encourage hiring temporary summer student workers, who can be the key to developing the future BLM workforce while augmenting condition and trend monitoring. This approach is in stark contrast to contracting AIM work which may save dollars in the short term but provides no long-term investment in personnel development and recruitment.*

9. Issue: There seems to be an increasing amount of livestock trespass on the public lands.

***Recommendation**: Range specialists need to stay on top of activities happening on allotments as they relate to actual use. Counting livestock in the field should be a top workload priority. Advanced technologies (e.g., remote sensing) could be used to improve enforcement and aircraft should be employed in critical cases. When trespass is identified, grazing regulations need to be unambiguously enforced. Evaluations of trespass enforcement should regularly be done in each field office, and formal program evaluations should be done in field offices according to schedules defined in manual guidance.*

F: Monitoring Model Concept

Model Development

1. **The trigger is a:**
    - Permit authorization
    - Project (i.e. restoration, fuel break, guzzler, etc.)
    - Plan (i.e. RMP, field development plan, etc.)
    - Program (i.e. WH&B census, sensitive species population)

2. **Potential monitoring needs are identified to address:**
    - Unresolved conflicts
    - Unknown consequences
    - Others?

3. **The commitment to monitor might be identified in a:**
    - EA Decision Record
    - EIS ROD
    - MOU
    - Others?

4. **Developing a monitoring plan:**
    - Specific questions to be addressed
    - Attributes to be monitored
    - Sampling design and methodology
    - Anticipated analysis tools
    - Data management strategy
    - Provisions for QA/QC

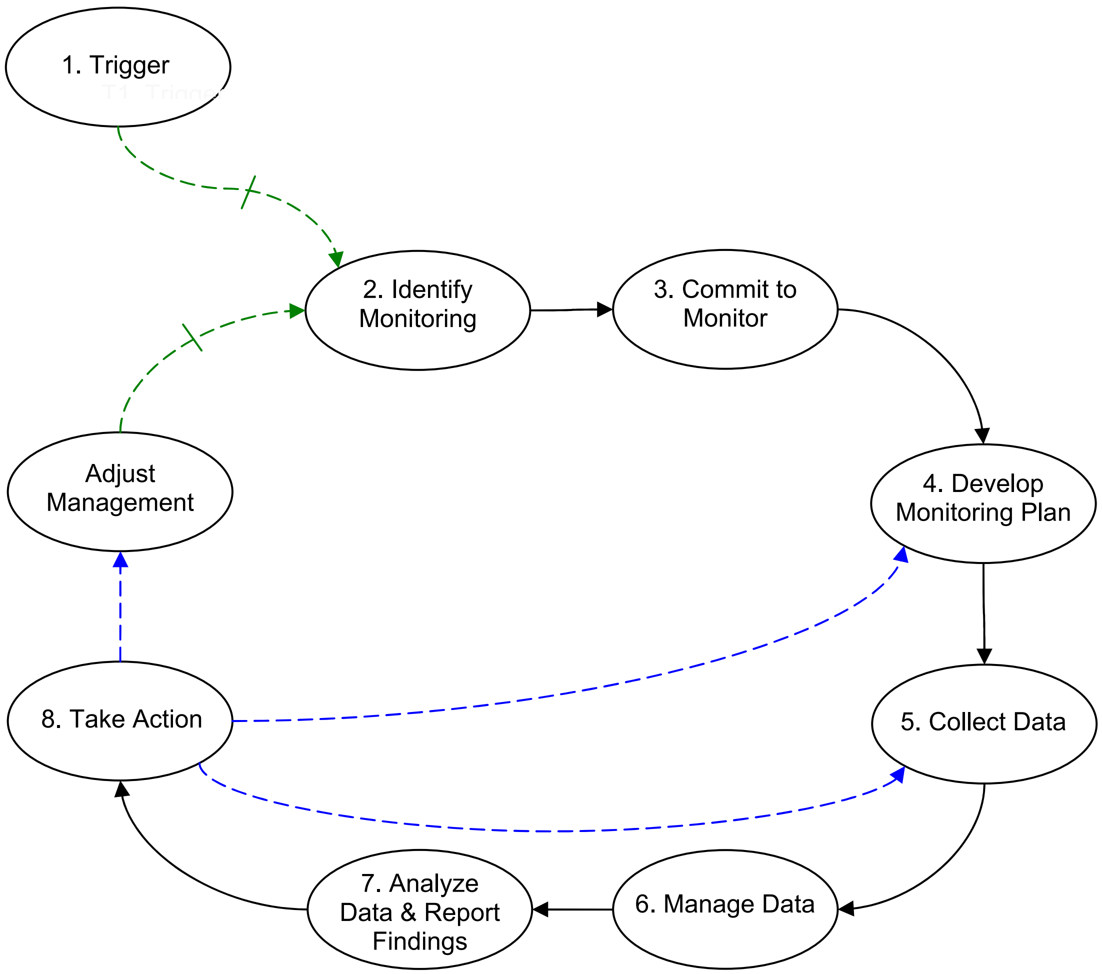
5. **Collect the Data**

6. **Manage the Data**

7. **Analyze Data and Report the Findings**

8. **Take action**
    - Continue to collect data
    - Refine monitoring plan
    - Identify additional or different monitoring needs
    - Adjust the management, including stopping the project

MONITORING MODEL FLOW DIAGRAM



G: Monitoring Practices Survey

Purpose: Thank you for agreeing to take this survey. The purpose of this survey is to help the BLM understand the nature and scope of its land-health related resource monitoring efforts, primarily at the Field Office level. The survey will also help determine whether our plans and management actions are having the desired effects. When combined with other survey responses, your answers will be used to understand the following broad questions about the BLM as a whole:

What data are we collecting regarding natural resource conditions, and with what frequency?

- Why are we collecting those data?
- How are data collected?
- How are data stored and analyzed?
- How, and by whom, are the data being used? In particular, does analysis of the data lead to management recommendations and does it help the BLM understand conditions and trends?
- Does analysis of the data help us determine our effectiveness, and thereby help us focus our investments?

This survey is designed to gain an understanding of the overall status of the Bureau's monitoring program, not to evaluate individual employees' monitoring activities.

Definition and Scope: For purposes of this survey, we refer to inventory, assessment, and monitoring simply as "monitoring", but we're really interested in all three activities. Monitoring activities could include data collection, data analysis and presentation, supervision of employees who monitor, administration of monitoring contracts, etc. By data collection we mean - collecting data in the field or remotely (e.g. from satellite imagery, aerial photos, etc.), or by other means. The data collected could be qualitative or quantitative.

This scope of this survey is land health-related resource monitoring. Respondents should not include compliance activities such as inspection and enforcement, use supervision, or permit compliance unless it is tied to monitoring of resource impacts such as soil erosion, revegetation success, etc.

Confidentiality: Responses to the statements in this survey will be summarized and represented statistically. The survey process is structured to ensure that individual employees are not identified. The individual survey responses will not be reviewed by management.

Who should take this survey: This survey should be completed by employees involved with monitoring, inventories or assessments relating to land health. This includes employees who collect and/or analyze monitoring data as well as those who may use monitoring data secondarily, such as managers or supervisors.

Instructions: The survey should take about 30 minutes to complete. Please answer the questions to the best of your ability. *Your monitoring activities are likely to vary from year to year. When answering the survey questions, please characterize your activities over the last three years.*

Required questions are indicated with a red asterisk (*). Please use the browser's back button if you want to check your answers from a previous screen. You will need to complete the survey in one session (you can't store partial results then log-on later).

If you would like to clarify the meaning or intent of any of the following questions, please call Dan Muller at (303) 236-7198 or Jenna Whitlock at (202) 452-5157.

S. Please complete the following general questions about your job, where you work and your experience with monitoring. required *

1. In what office do you work? *

○ Alturas Field Office
○ Anchorage Field Office

○ Artic Field Office
○ Ashland Resource Area
○ Bakersfield Field Office
○ Barstow Field Office
○ Battle Mountain Field Office
○ Bishop Field Office
○ Bruneau Field Office
○ Buffalo Field Office
○ Elko Field Office
○ Ely Field Office
○ Glendale Resource Area
○ Glenwood Springs Field Office
○ Grand Junction Field Office
○ Gunnison Field Office
○ Kemmerer Field Office
○ Kingman Field Office
○ Klamath Falls Resource Area
○ Lake Havasu Field Office
○ Lewistown Field Office
○ Little Snake Field Office
○ Malheur Resource Area
○ Mile City Field Office
○ Newcastle Field Office
○ Price Field Office
○ Roswell Field Office
○ Safford Field Office
○ Saguache Field Office
○ Salmon Field Office
○ Salt Lake Field Office
○ Socorro Field Office
○ South River Resource Area
○ Tucson Field Office
○ Ukiah Field Office
○ Upper Snake Field Office
○ Other

1a. Other Please specify ____________________________________

2. What is your job title? *

○ Ecologist
○ Botanist
○ Botany Technician
○ Rangeland Management Specialist
○ Range Technician
○ Forester
○ Forestry Technician
○ Soil Scientist
○ Fishery Biologist
○ Fishery Technician
○ Riparian Specialist
○ Wildlife Biologist
○ Wildlife Technician
○ Biological Technician
○ Archaeologist
○ Archaeological Technician
○ Outdoor Recreation Planner
○ Recreation Techician
○ Wilderness Specialist
○ Natural Resource Specialist
○ Hydrologist
○ Hydrology Technician
○ Environmental Protection Specialist
○ Geologist
○ Surface Protection Specialist
○ Biologist
○ Petroleum Engineer Technician
○ Petroleum Engineer
○ GIS Specialist
○ Wild Horse and Burro Specialist
○ Realty Specialist
○ Weed Specialist
○ Planning & Environ. Coordinator
○ Physical Scientist
○ Field Manager
○ Assistant Field Manager
○ Other

2a. Other
Please specify ____________________________________

required *
3a. How many years have you been involved in monitoring activities during your career? (Choose one.)

○ 0-5 years
○ 6-10 years
○ 11-15 years
○ 16-20 years
○ more than 20 years

3b. How has the amount of time you spend in monitoring activities changed over time? (Choose one.)

○ substantially increased
○ increased
○ no change

- ○ decreased
- ○ substantially decreased

3c. Are you a Manager or Supervisor who uses, but does not routinely collect or analyze monitoring data? (Choose one.) *

- ○ Yes
- ○ No

required *

4. About what percent of your time do you spend involved in monitoring activities (field data collection, data analysis and presentation, supervision of employees who monitor, monitoring contract administration, etc.)? (Choose one.) *

- ○ 0%
- ○ 1 to 9%
- ○ 10 to 29%
- ○ 30 to 49%
- ○ 50 to 69%
- ○ 70 to 99%
- ○ 100%

S. This section of the survey is intended to identify your top three monitoring activities, and what type of data are being collected. Remember, "monitoring" includes inventory, assessment and monitoring. Please select your top three monitoring activities from the drop down menus. You'll later be asked a series of questions about each of your top activities. Be sure to select "Not Applicable" if you have less than three top activities.

required *

First Monitoring Activity required. If you have less than three top activities, please select "Not Applicable" for second or third monitoring activity.

What are your top three monitoring activities? *
Please click the link below for additional description of Monitoring Activities.
Definitions of Categories:
5a. First Monitoring Activity

- ○ Soil or Soil Biota
- ○ Rangeland/Upland Habitat
- ○ Forest/Woodland Habitat
- ○ Fire/Fuels
- ○ Invasives
- ○ ESR or Restoration
- ○ Riparian
- ○ Aquatic Habitat
- ○ Water Quality or Quantity
- ○ Special Status Plants
- ○ Animal Population
- ○ Air Quality
- ○ Climate
- ○ Lands or Minerals
- ○ Recreation
- ○ Travel & Transportation
- ○ Wilderness/WSA, National Trails or Rivers
- ○ Other:

5b. First Monitoring Activity (from list above)
5c. First Monitoring Activity (from list above)
Q. No of Monitoring Activities_______

5d. You selected Other for your first monitoring activity.
Please specify ____________
5e. You selected Other for your second monitoring activity.
Please specify __________
5f. You selected Other for your third monitoring activity.
Please specify ____________

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6a. What type of data are you collecting when you are monitoring **[1st monitoring activity]**? (Please select all that apply.)

- ☐ Soil Survey and/or Investigations
- ☐ Contaminant sampling and lab analysis
- ☐ Erosion modeling, visual observations, and/or measurement
- ☐ Rangeland Health Evaluation, using Interpreting Indicators of Rangeland Health
- ☐ Soil/water repellency (i.e. post-fire)
- ☐ Soil Aggregate Stability
- ☐ Soil moisture by meter, gravimetric, etc
- ☐ Soil compaction: Densiometers, gravimetric, resistance (penetrometers), etc.
- ☐ Cover, using Daubenmire, Line Intercept, Line Point Intercept, Cover Board, Quadrat, Step Point, etc. (Includes biological soil crusts.)
- ☐ Soil Chemical Properties: electrical conductivity (EC), pH, Sodium Absorption Ratio (SAR), etc.
- ☐ Slope Stability Analysis: direct observation, modeling, photos, etc.
- ☐ **Other: Fill in the blank** ___________________________________
- ☐ Cover, using Daubenmire, Line Intercept, Line Point Intercept, Cover Board, Quadrat, Step Point, etc.
- ☐ Frequency, using Nested Plot Frequency, etc.
- ☐ Density, using Quadrat, etc.
- ☐ Production, using Double Weight Sampling, Harvest, Comparative Yield, etc. (not ESI)
- ☐ Seral Status, using Ecological Site Inventory (ESI)
- ☐ Structure, using Robel Pole, Cover Board, Community Structure Analysis (CSA) etc.
- ☐ Vigor, i.e. seed head production, reproductive tiller, adequate root development, etc.
- ☐ Vegetation Composition, using Dry-Weight, etc.
- ☐ Utilization, including herbaceous and/or woody species using various techniques
- ☐ Rangeland Health Evaluation, using Interpreting Indicators of Rangeland Health
- ☐ Other Qualitative techniques like estimation of apparent trend, etc.
- ☐ Habitat Suitability or Quality Assessment (i.e. sensitive species habitat assessments)
- ☐ Habitat Mapping (i.e. shrub stands, suitable, marginal or unsuitable habitat)
- ☐ Current Vegetation Survey (CVS)
- ☐ Vegetation or plant community inventory and/or mapping
- ☐ Photo plots only
- ☐ **Other: Fill in the blank** ___________________________________
- ☐ Stand Exam
- ☐ Site productivity, include TPCC, etc.
- ☐ FORVIS Inventory
- ☐ Microstorms Inventory
- ☐ Fire Regime Condition Class (landscape scale) using Interagency FRCC Guidebook methodology, etc.
- ☐ Current Vegetation Survey (CVS)
- ☐ Regeneration Surveys
- ☐ Habitat Suitability or Quality Assessment (i.e. sensitive species habitat assessments)
- ☐ Habitat Mapping (i.e. shrub stands, suitable, marginal or unsuitable habitat)
- ☐ Disease or Die Off
- ☐ Vegetation or plant community inventory and/or mapping
- ☐ **Other: Fill in the blank** ___________________________________
- ☐ Pre and Post Treatment species composition using FIREMON techniques, etc.
- ☐ Fuel Loading using Planar Intersect, FIREMON protocols, etc.
- ☐ Pre and Post Treatment stand level vegetation departure using Interagency FRCC Guidebook methodology, etc.
- ☐ Fire Regime Condition Class (landscape scale) using Interagency FRCC Guidebook methodology, etc.
- ☐ Pre and Post Treatment canopy cover using line intercept, point cover, FIREMON protocols, etc.

- ☐ Burn Severity, using Normalized Burn Ratio, Composite Burn Index (outlined in FIREMON protocols), etc.
- ☐ Cover or bare ground using FIREMON protocols
- ☐ Burn Mortality using FIREMON protocols
- ☐ Tree Data (species, size class, DBH, density) using fixed plot sampling described in FIREMON.
- ☐ Fire Behavior Variables (flame length, flame height, residence time, flame zone depth, rate of spread) using FIREMON protocols or Fire Effect Monitoring Guidebook
- ☐ Current Vegetation Survey (CVS)
- ☐ Successional Development using a plot sampling methods, etc.
- ☐ **Other Fill in the Blank** ___________________________________
- ☐ Population Inventory and Mapping (weed species, location, acreage, density, etc.) using various techniques.
- ☐ Treatment effectiveness and effects on non-target using line intercept, quadrat, etc.
- ☐ Population growth rate (rate of spread) using various techniques.
- ☐ **Other: Fill in the blank** ___________________________________
- ☐ Cover, using Daubenmire, Line Intercept, Line Point Intercept, Cover Board, Quadrat, Step Point, etc.
- ☐ Frequency, using Nested Plot Frequency, etc.
- ☐ Density, using Quadrat, etc.
- ☐ Production, using Double Weight Sampling, Harvest, Comparative Yield, etc.
- ☐ Community Structure Analysis (CSA), cover, density, frequency and structure
- ☐ Vigor, i.e. seed head production, reproductive tiller, adequate root development, etc.
- ☐ Photo plots only
- ☐ **Other: Fill in the blank** ___________________________________
- ☐ Functioning condition using Proper Functioning Condition (PFC)
- ☐ Utilization, including herbaceous and/or woody species using various techniques
- ☐ Vegetation composition, using techniques such as Green Line, PachFish Indicator Biological Opinions (PIBO), Multiple Indicator Monitoring, Current Vegetation Survey (CVS), photo plots, Vegetative Cross Section Composition, etc
- ☐ Community Typing or Inventory, Pfister and Hansen, Ecological Site Inventory, Winward, etc.
- ☐ Age Class, using aerial photos, etc,
- ☐ Streambank Stability/Alternation
- ☐ **Other: Fill in the blank** ___________________________________
- ☐ Habitat features (spawning gravel quality, large woody debris, width-depth ratio, pool-riffle ratio, bankfull width, channel entrenchment, sinuosity, substrate, bank stability, etc) using Rosgen, Hankin-Reeve, etc.
- ☐ Channel classification, using Montgomery-Buffington, Rosgen, etc.
- ☐ Functioning condition using Proper Functioning Condition (PFC)
- ☐ Instream Flow Incremental Methodologies (PHABSIM, RHABSIM)
- ☐ PachFish Indicator Biological Opinions (PIBO)
- ☐ **Other: Fill in the blank** ___________________________________
- ☐ Quality (temperature, sediment, water chemistry, other constituents, etc.) using direct measurement; continuous thermograph, light transmission, sediment collection, etc
- ☐ Discharge using various gauges, weirs, stage measurements
- ☐ Instream Flow Incremental Methodologies (PHABSIM, RHABSIM)
- ☐ **Other: Fill in the blank**
- ☐ Species presence, using complete population counts, intuitive controlled inventory, etc.
- ☐ Population or site condition, using various techniques
- ☐ Cover, using Daubenmire, Line Intercept, Line Point Intercept, Cover Board, Quadrat, Step Point, etc.
- ☐ Frequency, using Nested Plot Frequency, etc.
- ☐ Density, using Quadrat, etc.
- ☐ Production, using Double Weight Sampling, Harvest, Comparative Yield, etc.
- ☐ Structure, using Robel Pole, Cover Board, Community Structure Analysis (CSA) etc.
- ☐ Vegetation Composition, using Dry-Weight, etc.

☐ Utilization, including herbaceous and/or woody species using various techniques
☐ Photo plots only
☐ **Other Fill in the Blank** ___________________________________
☐ Wild Horse and Burro population monitoring by various techniques (direct count, simultaneous double count, mark resight, etc.)
☐ Special Status aquatic species using various techniques. Includes Survey and Manage.
☐ Non-Special Status Aquatic species using electroshocking, netting, seining, macroinvertebrate collection, plankton netting, etc.
☐ Special Status terrestrial species (game and non-game) using various techniques
☐ Non-game terrestrial species (non-Special Status) using various techniques
☐ Game terrestrial species (non-Special Status) using various techniques
☐ **Other: Fill in the Blank** ___________________________________
☐ Photographic methods
☐ Direct measure, gravimetric for PM-10,2.5
☐ **Other: Fill in the Blank** ___________________________________
☐ Precipitation gauges
☐ RAWS weather station
☐ NOAA weather stations
☐ **Other: Fill in the Blank** ___________________________________
☐ Unreclaimed Surface Disturbance using ocular estimates, line intercept, aerial photos, remote sensing, etc.
☐ Successful Reclamation - Interim and Final; ocular estimate, line intercept, aerial photos, remote sensing
☐ **Other: Fill in the Blank** ___________________________________
☐ Permitted recreation use, using direct measurement, observation, photo points, etc.
☐ Casual recreation use, using direct measurement, observation, photo points, etc.
☐ Non-WSR Rivers, using direct measurement and observations or other various techniques
☐ Visitor numbers and demographics, using mechanical or automated counter, registration/permits, one-on-one interviews, formal surveys, personal observations, etc.
☐ Visitor satisfaction, expectations and benefits, using one-on-one interviews, formal surveys, comment cards, personal observations, etc.
☐ Recreation site condition, using condition assessments, observation, photo points, etc.
☐ Visual resources (VRM), using direct measurement, observation, photo points, etc.
☐ Recreation use or other physical impacts, using direct measurement and observation, etc.
☐ **Other: Fill in the Blank** ___________________________________
☐ Visitor numbers and demographics, using mechanical or automated counter, registration/permits, one-on-one interviews, formal surveys, personal observations, etc.
☐ Visitor satisfaction, expectations and benefits, using one-on-one interviews, formal surveys, comment cards, personal observations, etc.
☐ Route inventory
☐ Route condition
☐ Noise (decibel), using direct measurement, etc.
☐ Recreation site condition, using condition assessments, observation, photo points, etc.
☐ Visual resources (VRM), using direct measurement, observation, photo points, etc.
☐ Recreation use or other physical impacts, using direct measurement and observation, etc.
☐ **Other: Fill in the Blank** ___________________________________
☐ Requirements of enabling legislation (or proclamation), using various techniques
☐ Wilderness characteristics, using various techniques
☐ Wild and Scenic River values, using various techniques
☐ National Historic or Scenic Trail characteristics, using various techniques, including use of Interagency Trail Data Standards, etc.
☐ Linear evaluation or assessment (rivers, trails, routes, etc.) using field observations or other various techniques
☐ **Other: Fill in the Blank** ___________________________________
☐ **Other: Fill in the Blank** ___________________________________

6b. and 6c. are picks from above list for 2nd and 3rd Monitoring Activities, respectively

7a. Of the time you spend monitoring, what percent do each of the following monitoring activities take?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ 0%
○ 1 to 9%
○ 10 to 29%
○ 30 to 49%
○ 50 to 69%
○ 70 to 99%
○ 100%

8a. Under what Program Elements (PEs) do you typically report **[1st monitoring activity]** monitoring accomplishments (e.g. "widgets")? (Please select all that apply.)

☐ BA - Inventory Recreation Resources
☐ BF - Assess Hazmat Sites
☐ BG - Assess Other Hazards (Non Hazmat or AML)
☐ BN - Inventory Water Resources
☐ BO - Inventory Soil Resources
☐ BP - Assess Watersheds
☐ BQ - Complete Ecological Site Inventory
☐ BR - Inventory Shrub/Grass/PJ Vegetation
☐ BS - Inventory for Presence of Invasive and/or Noxious Weeds
☐ BT - Inventory Forest/Woodland Vegetation
☐ BU - Inventory Lakes/Wetland Areas
☐ BV - Inventory Streams/Riparian Areas
☐ BY - Assess Linear Recreation Resources
☐ BZ - Assess Designated Rivers and Trails
☐ CB - Inventory Wildlife/Plan Habitat
☐ DJ - Evaluate Land Use Plans
☐ MA - Evaluate Recreation Areas
☐ MC - Conduct Census of Wild Horse and Burro Areas
☐ MB - Evaluate Forest/Woodland Treatments
☐ MD - Monitor Wilderness and WSAs
☐ MF - Evaluate Designated Rivers and Trails
☐ MG - Monitor and Maintain Hazmat & NRDAR Sites
☐ MI - Monitor Air Resources/Climatic Conditions
☐ MJ - Evaluate Rangeland Health
☐ MK - Evaluate Weed Treatments
☐ ML - Monitor Grazing Allotments
☐ MN - Monitor Lake/Wetland Habitat
☐ MO - Monitor Stream/Riparian Habitat
☐ MP - Monitor WHB HMAs
☐ MQ - Monitor Terrestrial Habitat
☐ MR - Monitor Species Populations
☐ MT - Monitor Fuels Treatment
☐ MU - Monitor Water Resources
☐ MV - Evaluate Linear Recreation Management Objectives
☐ MX - Monitor Shrub/Grass Vegetation Treatments
☐ MZ - Monitor Fire Rehab Treatments
☐ Don't know
☐ Other, please specify ___________________________________

9a. How well do these PEs represent the **[1st monitoring activity]** monitoring work performed?

- ○ Not at All 1
- ○ 2
- ○ 3
- ○ 4
- ○ Very Well 5

9aa. How could PEs be changed to better represent the work performed?
Comment: (Narrative response.)

____
____

The questions above are repeated for each monitoring activity.

S. This section of the survey will help identify why monitoring data are collected.

10a. To what extent do the following drive monitoring? Please indicate a percentage, totaling 100% for each monitoring activity.

	[1st monitoring activity]	**[2nd monitoring activity]**	**[3rd monitoring activity]**
Permits or other Use Authorizations (e.g. Application for Permit to Drill (APD), grazing permit, timber sale, special recreation permit, etc. This includes monitoring identified in Biological Opinions (BOs) or Environmental Assessments (EAs) associated with permit issuance.)?	____	____	____
Resource Management Plan decision			
Projects not subject to permitting (for example inventory or monitoring for a restoration project, fuels treatment, etc. This includes any monitoring identified in BOs or EAs associated with projects.)			
Program direction (e.g. Special Status Species, Wildlife, Fire/Fuels, WH&B, etc.)			
Court Order or Settlement Implementation			
Other, please specify:			

10aa. Other ______________________________

11a. You indicated Other (something other than Permits, RMPs, projects, program direction, or court order) most drove monitoring. Please explain further why collecting those data was a priority?

____
____

12a. You indicated that "Permits or other Use Authorizations" drove monitoring. Which of the following activities most drives your permit-related monitoring?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

- ☐ Fluid minerals
- ☐ Solid minerals
- ☐ Lands and Realty actions
- ☐ Grazing
- ☐ Timber sales
- ☐ Special recreation permits
- ☐ Other, please specify

12aa. Other Specify. 1 _____________ 2 _____________ 3 _____________

13a. Which of the following most applies to the need for your monitoring data? Please rate on a scale of 1 to 5, with 5 being the most applicable.

	[1st monitoring activity]	**[2nd monitoring activity]**	**[3rd monitoring activity]**
Data are needed to as a foundation for an RMP or other plan Data are needed to authorize a use or issue a permit Data are needed to determine if permit terms and conditions or stipulations are adhered to Data are needed to determine if management actions are having the desired effect, or if objectives are met Data are needed to determine if estimated impacts were accurately projected in NEPA documentation Other, please specify	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Not Applicable	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Not Applicable	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Not Applicable

13aa. Other Specify 1 ________________________

S. This section of this survey will help identify how monitoring data are collected (including frequency of collection).

14a. Please indicate what percent of monitoring data are collected by each of the following (should equal 100% for each monitoring activity.)

	[1st monitoring activity]	**[2nd monitoring activity]**	**[3rd monitoring activity]**
Permanent Employees Temporary Employees (including those on 1039 or Term appointment) BLM Contractor Volunteers Agreements (e.g. through Challenge Cost Share) Partners User or permittee Other State or Federal agency Other, please specify	____	____	____

14aa. Other Specify ___________________

15a. What percent of the data are collected through user or permittee contributed funds or through cost recovery.

[1st monitoring activity] [2nd monitoring activity] [3rd monitoring activity]	○ 0% ○ 1 to 9% ○ 10 to 29% ○ 30 to 49% ○ 50 to 69% ○ 70 to 99% ○ 100%

16a. How are monitoring data collected (select all that apply)?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

☐ Collected in the field?
☐ Remotely sensed (e.g. color infrared, true color, etc.)?
☐ Modelled?
☐ Other, please specify

16aa. Specify 1 ____________ 2 ____________ 3 ____________

17a. Which of the following best represents the means by which monitoring data are initially recorded in the field?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Hard copy notation (e.g. recorded on paper)
○ Electronic (e.g. PDA, laptop, notebook, GPS)
○ Other, please specify

17aa. Specify 1 ____________ 2 ____________ 3 ____________

18a. How often are monitoring data reviewed by a peer or supervisor prior to use in a document?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Never 1
○ 2
○ 3
○ 4
○ Always 5
○ Not Applicable

19a. How well are individuals who collect monitoring data trained on techniques and protocols for data collection?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Not very well 1
○ 2
○ 3
○ 4
○ Very Well 5
○ Not Applicable

20a. Is there sufficient guidance (Technical References, Handbooks, Manuals, IMs etc.) to ensure that monitoring data are collected in accordance to Bureau protocols?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Insufficient 1
○ 2
○ 3
○ 4
○ Sufficient 5
○ Don't Know

21a. How often is guidance (Technical References, Handbooks, Manuals, Instruction Memoranda, etc.) followed when collecting data?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Never 1
○ 2
○ 3
○ 4
○ Always 5
○ Not applicable (e.g. there is not guidance)

22a. Are monitoring data collected with techniques that are *consistent enough over time* so that a meaningful trend can be identified?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Yes
○ No
○ Not Applicable

24a. Are monitoring data collected *often enough* to identify meaningful trend and support decisions.

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Yes
○ No
○ Not applicable

24aa. If you indicated no to any of the above, please explain why.

____
____

24aaa. How often are monitoring activities based on an ecological model (description of the relationship between species biology and management activities).

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Never 1
○ 2
○ 3
○ 4
○ Always 5
○ Not applicable

S. This section of the survey will help understand how data that you collect are stored and analyzed.

25a. How are monitoring data stored or managed? (select all that apply)

	[1st monitoring activity]	**[2nd monitoring activity]**	**[3rd monitoring activity]**
Hard copy (e.g. paper files, mylar)	☐ 1	☐ 1	☐ 1
Commercial, off the shelf spreadsheet/database (e.g. Excel, Access, etc.)			
Commercial GIS (e.g. ArcInfo, etc.)			
Commercial statistical software (e.g. SPSS, etc.)			
BLM National application (e.g. ESR database, etc.)			
Application developed by State Office (e.g. VMAP, ISMS, etc.)			
Application developed locally, at Field or District Office			
Applications developed by other Federal or State agencies (e.g. National Hydrography Dataset, Aquatic Resources Information System, NRCS Web Soil Survey)			
Other, please specify:			

25aa. Specify 1 ______________

26a. How much of the monitoring data can be linked to GIS?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ Almost all of the data
○ Most of the data
○ Some of the data
○ Little of the data
○ None of the data
○ Not Applicable Don't know

27a. Of the monitoring data collected to date which is appropriate for GIS, how much is currently in GIS?

[1st monitoring activity]
[2nd monitoring activity]
[3rd monitoring activity]

○ More than 79%
○ 60-79%
○ 40-59%
○ 20-39%
○ Less than 20%

S. This section of the survey will help identify who has access to and uses the monitoring data, and how the data are used.

28a. For **[1st monitoring activity]**

How effectively do the data allow you to describe current existing condition of the land?
How effectively do your monitoring data explain changes in resource condition or trend?
How effectively are trends in resource condition correlated with management actions (e.g. stream conditions improve with improved grazing practices)?
How effectively do multiple programs use the same monitoring data?
How effectively are data aggregated to multiple levels (e.g. across allotments, Planning Units, Field Offices, geographic regions)?

○ Very Ineffectively 1
○ 2
○ 3
○ 4
○ Very Effectively 5
○ Not Applicable Don't know

28b. For **[2nd monitoring activity]**

How effectively do the data allow you to describe current existing condition of the land?
How effectively do your monitoring data explain changes in resource condition or trend?
How effectively are trends in resource condition correlated with management actions (e.g. stream conditions improve with improved grazing practices)?
How effectively do multiple programs use the same monitoring data?
How effectively are data aggregated to multiple levels (e.g. across allotments, Planning Units, Field Offices, geographic regions)?

○ Very Ineffectively 1
○ 2
○ 3
○ 4
○ Very Effectively 5
○ Not Applicable Don't know

28c. For **[3rd monitoring activity]**

How effectively do the data allow you to describe current existing condition of the land?
How effectively do your monitoring data explain changes in resource condition or trend?
How effectively are trends in resource condition correlated with management actions (e.g. stream conditions improve with improved grazing practices)?
How effectively do multiple programs use the same monitoring data?
How effectively are data aggregated to multiple levels (e.g. across allotments, Planning Units, Field Offices, geographic regions)?

○ Very Ineffectively 1
○ 2
○ 3
○ 4
○ Very Effectively 5
○ Not Applicable Don't know

S. The following questions pertain to your Office's monitoring activities in general.

29. What percentage of your Office's monitoring activities are conducted according to a monitoring plan?:

○ More than 79%
○ 60-79%
○ 40-59%
○ 20-39%
○ Less than 20%
○ Don't Know

29a. Which of the following monitoring activities are covered by a monitoring plan? (Select all that apply)

☐ Soil or Soil Biota
☐ Rangeland/Upland Habitat
☐ Forest/Woodland Habitat
☐ Fire/Fuels
☐ Weeds
☐ ESR or Restoration
☐ Riparian (lentic and lotic)
☐ Aquatic Habitat
☐ Water Quality or Quantity
☐ Special Status Plants (vascular and non-vascular). Includes Survey and Manage.
☐ Animal Population (vertebrate and invertebrate). Includes aquatic and terrestrial game and non-game, Survey and Manage, and Special Status, etc.
☐ Air Quality
☐ Climate
☐ Lands or Minerals
☐ Recreation (includes permitted and casual activities including dispersed, rivers, camping, climbing, caving, hunting, etc.)
☐ Travel & Transportation (roads, primitive roads, and trails and related travel types)
☐ Wilderness/WSA, National Trails or Rivers (includes wilderness, WSA, National Trails and/or Wild and Scenic Rivers)
☐ Other: ___________________
☐ Don't Know

31. How often are monitoring activities coordinated among the different programs in your office? (For example, range and wildlife studies are coordinated)? (Choose one)

○ Never 1
○ 2
○ 3
○ 4
○ Always 5

32. Within the last 3 years, has data quality, or lack of monitoring data been an issue in formal appeals of decisions, or lawsuits related to decisions?

○ Yes
○ No
○ Don't know

33. When challenged in court, how often are decisions upheld?

○ Never 1
○ 2
○ 3
○ 4
○ Always 5
○ Don't Know

34. How often are the results of monitoring analysis data summarized in a written report?
- ○ Never 1
- ○ 2
- ○ 3
- ○ 4
- ○ Always 5
- ○ Not Applicable

34a. How often are monitoring data shared with the public?
- ○ Never 1
- ○ 2
- ○ 3
- ○ 4
- ○ Always 5

35. How often are monitoring data adequate (e.g. sufficient quantity and quality, appropriateness) to support land management decisions?
- ○ Data usually inadequate to support decisions 1
- ○ 2
- ○ 3
- ○ 4
- ○ Data usually adequate to support decisions 5
- ○ Not Applicable

36. Are resources available to meet mandatory monitoring requirements (e.g. from Biological Opinions, Court Orders, etc?)
- ○ Never 1
- ○ 2
- ○ 3
- ○ 4
- ○ Always 5
- ○ Not Applicable

37. How often do monitoring data help decide if land management actions taken by BLM are having the desired effect?
- ○ Never 1
- ○ 2
- ○ 3
- ○ 4
- ○ Always 5

38. How often does monitoring cause your Office to change land management actions? (For example,

management practices have been changed because a new T & E species population is located, or water quality has degraded, etc.)

- ○ Never 1
- ○ 2
- ○ 3
- ○ 4
- ○ Always 5

38a. How often is the monitoring design reviewed and revised when management actions change.

- ○ Never 1
- ○ 2
- ○ 3
- ○ 4
- ○ Always 5

39. How effectively does monitoring help your Office determine land management priorities? (E.g., if there is funding to treat only 50K acres of vegetation in poor condition, monitoring helps identify which acres to treat.)

- ○ Very Ineffectively 1
- ○ 2
- ○ 3
- ○ 4
- ○ Very Effectively 5

40. Please comment on how monitoring data analysis has helped determine priorities in your Field Office:

____

H: Monitoring Practices Survey Results and Analysis

Preface to the AIM Local Level Employee Survey Briefing

Introduction

Attached to this preface is a briefing on the results and findings of the AIM local level employee survey. The briefing was initially prepared for the local level group which had been intimately involved in the development and administration of the survey. The briefing attached was refined and focused on findings for the AIM core team. As such it needs some general explanation and extrapolation to adapt it to management needs, as well as to focus on the National Monitoring Strategy management questions. This is the purpose of this preface.

Survey Background

The survey was designed in partnership between the BLM local-level AIM team and Coray Gurnitz Consulting (CGC). It was administered in the summer of 2006. CGC completed the analysis. Findings were extracted from the survey analysis by CGC in partnership with the local-level AIM team.

Responses came back from 277 employees in a stratified random sample of 37 field and resource area offices. The survey had 40 major questions with many subparts, providing over 800 variables for analysis. Sixty percent (60%) of these variables are about type of monitoring within disciplines. Of the respondents, 161 were employees who participate over 10% of their time in one to three monitoring activities, providing data on 414 monitoring activities (confidence level 95%, ± 4%).

Survey Design, Analysis and Findings

The survey was developed around 7 major questions:

1. What are the demographic characteristics of monitoring employees?
2. What data are we collecting regarding natural resource conditions, and with what frequency?
   - Who collects what data?
3. Why are we collecting those data?
4. How are data collected?
5. How are data stored and analyzed?
6. How, and by whom, are the data being used?
   - In particular, does analysis of the data lead to management recommendations and does it help the BLM understand conditions and trends?
7. Does analysis of the data help us determine our effectiveness, and thereby help us focus our investments?

Since the survey was administered and as the work of the AIM teams has progressed, the AIM National Monitoring Strategy five key areas and attendant general management questions have evolved. These overarching questions are supplemented with additional questions at various scales. In the report to which this appendix is attached, the survey results have been recast from the original questions asked in its design to address the National Monitoring Strategy questions, particularly at the local scale.

Rather than repeat that report, this preface summarizes the major findings from the original survey design questions to retain its original analytic context. As such, in the section below, the question is restated, then the major findings are summarized.

Summary of Findings by Question

1. What are the demographic characteristics of monitoring employees? (slides 5-8)

   Facts:
   - Employees report an increase in monitoring workload over time.
   - Employees have a bimodal distribution in years of experience, i.e. 22% have less than 5 years experience and 26% have more than 20 years of experience. On average monitoring employees have 11 to 15 years of experience.
   - Managers spend up to 30% of their time on monitoring-related work (e.g. data analysis, decision making, project management…).

   Finding: There may be training and succession planning issues in the monitoring workforce.

2. What data are we collecting regarding natural resource conditions, and with what frequency? (slides 9-15)
   a. Who collects what data?

   Facts:
   - There is a wide range of data and methods used to conduct monitoring activities across and within programs, e.g. 16 for range, 6 for riparian, 6 for animal population, 11 for forest, and 3 for invasives.
   - In range & riparian, most everybody is doing rangeland health. These two monitoring activities are a large percentage of all monitoring activity.
   - Employees report that the PEs for 12 monitoring activities don't represent the monitoring work very well. For animal population and forest/woodland habitat monitoring activities which are fairly high frequency monitoring activities, employees report a particularly low fit of PEs to work.

   Findings:
   - There may be a more effective mix of types of data collected by program, given the budget and current science. The data can probably be collected in a more cost effective manner using economies of scale and standards.
   - Some PEs need to be adjusted, added or better defined: particularly CB, MR, MQ.

3. Why are we collecting those data? (slides 16-23)

   Facts:
   - Monitoring employees report that what most drives monitoring activities, in order from most drives to least drives, is: permits, program direction, projects, and RMP decisions drive monitoring. Court orders or settlements are the least important drivers of monitoring activity.
   - Much less of BLM's monitoring is driven by Resource Management Plan decisions (15%). When employees are asked why monitoring data is most needed, RMPs are ranked lowest. (q13a1-6)
   - While range and riparian are more likely to have a monitoring plan, 51% to 96% (depending on the program) of employees report no monitoring plans guide their work.

Findings:

- Since grazing permits drive more monitoring activity than anything else, it should be better funded, perhaps by cost-recovery.
- The connection between data collection and land use planning efforts is unclear to many employees, perhaps because the connection of assessment activities to land use planning efforts is itself unclear. Specifically, 39% of all monitoring activities are driven by permitting or other use authorizations. In the two monitoring activities that account for 35% of all MA (Range/Upland Health and Riparian), 55% and 49% of monitoring activities are driven by permits.
- As such, the local and program-specific nature of monitoring reduces the ability of BLM to accomplish more holistic land management and may lead to sub-optimized land management decisions. Further, the lack of monitoring plans to guide monitoring will reduce the overall utility and economy of the data and its collection.

4. How are data collected? (slides 24-41)

Facts:

- Permanent employees collect most of the monitoring data.
- Only 29% of the data collected is augmented in any way by user or permittee funds or cost recovery. Of these less than 30% of the cost is covered.
- 94% of data is collected in the field, 78% by hand. Of the 414 monitoring activities reported on in the survey, only 19% had any remote sensing and only 18% used electronic tools (e.g. PDAs, laptops, GPS…).
- Employees report that certain programs/monitoring activities have much better supervision, training and guidance than others.
- 37% of monitoring activities are not based on an ecological model. This is a greater problem for some programs (se slide 37).

Findings:

- Investment in remote sensing R&D and electronic tools for the two highest frequency monitoring activities (rangeland/upland habitat and riparian) is warranted, as such methods could decrease costs and reduce understaffing pressure.
- Air quality has low marks in supervisory review, training, and guidance. Other monitoring activities can be dramatically improved on one or more of these areas. See slides 32-34 that list these activities in order of those needing the most improvement.

5. How are data stored and analyzed? (slides 42-44)

Facts:

- Since 80% of data are not collected electronically, most data must be transcribed to get it into the COTS and FO applications that are automated.
- 57% of data can be linked to GIS, but only about 40% of data are linked to GIS.

Findings:

- Lack of automation of and GIS links to the data hampers use of data above the local level.

6. How, and by whom, are the data being used? (slides 45-52)
    a. In particular, does analysis of the data lead to management recommendations and does it help the BLM understand conditions and trends?

Facts:

- A large portion of the data is reported as *ineffective* in describing existing conditions (43%), in explaining changes in resource conditions (54%), correlating conditions to land management actions (56%).
- Further, about 73% of the data are *not* effective in serving across programs or at various aggregated levels. Also, the data are seldom coordinated across programs (74%), seldom reported (54%), and seldom shared with the public (74%)
- However, to the extent that these findings are about inventories (not able to determine with the survey), the findings should be discounted as inventories do not have trends or across program use as a purpose, per se. Further, the permitting nature of much monitoring also makes these facts somewhat less salient.

Findings:

- The caveats of inventories not going to trends and permits driving monitoring, are exactly the reason why the data are less useful at a regional or national level. By contrast, the Forest Service Nat'l Visitor Use Methodology model was designed from the start with serving a national need. As such it's utility decays at lower levels. But, its design does allow for scaling it up to meet local level needs. It would be difficult at best to scale BLM's fragmented local monitoring activities up to aggregate them to the regional or national levels.

7. Does analysis of the data help us determine our effectiveness, and thereby help us focus our investments? (slides 53-55)

Facts:

- 50% of monitoring employees report that within the last three years data quality or lack of monitoring data have been issues in formal appeals or lawsuits.

Findings:

- Again, monitoring strategy is local and fragmented by design. This may be reflected in legal challenges that may look at broader land management issues.

Conclusion

Perhaps the most important overall finding from the survey data is that AIM policies and practices seem to have evolved without regard to a large-scale model of expected outcomes (a program logic model, national strategy, etc.). As such the monitoring process is perfectly designed to get the local-level and impervious to aggregation results BLM gets. At some level such a model could drive monitoring behavior across disciplines and field operations. The lack of this national model or strategy is at the root of why BLM doesn't get the level of effectiveness from the data that it otherwise might.

- The data imply that:
  - AIM information is being gathered independently by FOs,
  - Over-arching policies that drive the data collection have been developed by programs operating independently of each other.
    - While much of the monitoring activity helps the immediate local multiple use customer to get the permit or use authorization needed and/or to comply with regulations, the bigger picture of the health of the land overall remains illusive.

Monitoring Study: Local Monitoring Survey

Results and Findings
January 24, 2007
Gaps Filled 2/21/07

Evaluation Questions

1. What data are we collecting regarding natural resource conditions, and with what frequency?
   - Who collects what data?
2. Why are we collecting those data?
3. How are data collected?
4. How are data stored and analyzed?
5. How, and by whom, are the data being used?
   - In particular, does analysis of the data lead to management recommendations and does it help the BLM understand conditions and trends?
6. Does analysis of the data help us determine our effectiveness, and thereby help us focus our investments?

Key to Abbreviations

- ME = Monitoring Employee, i.e. a respondent who selected at least one monitoring activity (q5a-q5c),
  - and, spend ≥10% of their time monitoring
  - and, are not supervisors who use monitoring data but don't routinely do monitoring

- MA = Monitoring Activity, i.e. generically any of the 17 monitoring activities specified in the survey

Survey Description

- **Survey development:**
  - **Team:**
    - Field: Steve Klessen, Rob Burton, John Spain…
    - HQ: Steve Tryon, Kit Muller, Jenna Whitlock, Dan Muller
    - Kevin Coray, Coray Gurnitz Consulting, Inc.
  - Pilot tested in Roswell, and then again in Winnemucca & Glasgow

- **Survey Characteristics:**
  - Web-enabled survey
  - 820 variables in survey from 40 questions and sub-parts
    - 60% on type of monitoring

- **Survey Administration Dates:**
  - June 22, 2006 to Aug. 28, 2006

- **Analysis Files:**
  - **Full data file**:
    - 277 respondents
      - Confidence: 95% ± 5%
    - 822 variables
  - **ME sub-sample**
    - N=161 respondents, reporting one or more monitoring activities
  - **Monitoring Activity data file**
    - N=414 cases
      - Confidence: 95% ± 3.7%
    - 1-3 cases per ME

Description of Sample

- Who responded? (as compared to who could have responded…)
  - Every FO in our identified sample responded

	Monitoring employee?		
q1. FO	**No**	**Yes**	**Total**
-1	1	1	2
Alturas FO	4	3	7
Anchorage FO	2	4	6
Artic FO		3	3
Ashland RA	4	14	18
Bakersfield FO	4	1	5
Barstow FO	1		1
Battle Mountain FO	3	5	8
Bishop FO	2	3	5
Bruneau FO	4	6	10
Buffalo FO	5	7	12
Elko FO	4	2	6
Ely FO	9	2	11
Glendale RA	7	7	14
Glenwood Springs FO	4	7	11
Grand Junction FO	2	3	5
Gunnison FO	3	3	6
Kemmerer FO	3	4	7
Kingman FO	2	5	7
Klamath Falls RA	2	4	6
Lake Havasu FO	3	6	9
Lewistown FO	6	3	9
Little Snake FO	3	1	4
Malheur RA	3	9	12
Miles City FO	4	8	12
Newcastle FO		1	1
Price FO	3	2	5
Roswell FO	1	6	7
Safford FO	3	6	9
Saguache FO	1		1
Salmon FO	3	3	6
Salt Lake FO	3	1	4
Socorro FO	2	3	5
South River RA	7	6	13
Tucson FO	3	4	7
Ukiah FO	2	4	6
Upper Snake FO	2	12	14
Medford DO	1	2	3
Total	**116**	**161**	**277**

Description of Sample

- Who responded?
  - 277 employees, of which 161 indicated they participate in one or more monitoring activities
  - Non-MEs are managers and/or others who spend less than 10% of time monitoring

	monitoring employee?		
	No	Yes	Table Total
-1	1		1
Generalist	8	23	31
Botany	2	3	5
Range	7	45	52
Forester	9	12	21
Soil Scientist		4	4
Fishery	1	10	11
Riparian Spec		1	1
Wildlife Bio	9	21	30
Archaeology	3	7	10
Recreation	11	9	20
Hydrology	5	7	12
Surface Protection		1	1
Geologist	1	4	5
Petroleum		1	1
GIS Spec	1	1	2
Wild Horse & Burro Spec	2	3	5
Realty Spec	1		1
Planning & Environ Coor	7	3	10
Manager	43	3	46
Other	1	1	2
Fire & Fuels	2	1	3
Engineering	2	1	3
Table Total	116	161	277

Description of Sample:

Monitoring Employees (MEs)

- 48% of MEs report an increase in monitoring over time; while 31% report a decrease; and 21% report no change (q3b).

- On average, MEs have had 11-15 years of experience with monitoring (range 0 to >20) (q3a)

q3a. How many years have you been involved in monitoring activities during your career?

Alternative	Frequency	Percent
0-5 years	36	22.4
6-10 years	35	21.7
11-15 years	22	13.7
16-20 years	27	16.8
> 20 years	41	25.5
Total	**161**	**100.0**

Finding:
48% of MEs have <5 yrs and > 20 yrs of experience. Respectively, this may highlight a training and a succession issue.

Description of Sample:

Percent of time spent in monitoring (q4)

q4. About what percent of your time do you spend involved in monitoring activities?

	Managers		***ME's***	
Alternative	**Frequency**	**Percent**	**Frequency**	**Percent**
0%	1	1.7	n/a	n/a
1 to 9%	16	27.6	n/a	n/a
10 to 29%	22	37.9	68	42.2
30 to 49%	11	19.0	45	28.0
50 to 69%	4	6.9	26	16.1
70 to 99%	4	6.9	18	11.2
100%			4	2.5
Total	**58**	**100.0**	**161**	**100.0**

🟧 = Mean & Median in this range

Finding:
70% of managers spend up to 30% of their time on monitoring. Do they need help managing science-based AIM?

1. What data are we collecting regarding natural resource conditions, and with what frequency?

Q5a-5c, 6a-c, 3b & 4 vs. ME, 7a1-3, 8-9a-c, 9aa-9cc

Q5a-c. Sum Across First to Third Monitoring Activities

Monitoring Activity Label	Total / Mon. Act.	Percent	Cum. %
Rangeland/Upland Habitat	87	21.0%	21.0%
Riparian	61	14.7%	35.7%
Animal Population	32	7.7%	43.5%
Forest/Woodland Habitat	32	7.7%	51.2%
Invasives	27	6.5%	57.7%
Fire/Fuels	21	5.1%	62.8%
Water Quality or Quantity	18	4.3%	67.1%
Soil or Soil Biota	16	3.9%	71.0%
Recreation	15	3.6%	74.6%
Aquatic Habitat	14	3.4%	78.0%
Special Status Plants	14	3.4%	81.4%
Travel & Transportation	13	3.1%	84.5%
ESR or Restoration	13	3.1%	87.7%
Lands or Minerals	12	2.9%	90.6%
Wilderness/WSA, Nat'l Trails or Rivers	11	2.7%	93.2%
Climate	5	1.2%	94.4%
Air Quality	2	0.5%	94.9%
Other:	21	5.1%	100.0%
Total	**414**		

Q6. What type of data is collected (by MA):

Rangeland Example (Highest frequency MA, n=87)

Type of Data Collected	Sum over MAs	Percent
Rangeland Health Evaluation, using Interpreting Indicators of Rangeland Health	74	85.1%
Cover, using Daubenmire, Line Intercept, Line Pt. Intercept, Cover Board, Quadrat, Step Point, etc.	64	73.6%
Utilization, including herbaceous and/ or woody species using various techniques	63	72.4%
Frequency, using Nested Plot Frequency, etc.	43	49.4%
Other Qualitative techniques like estimation of apparent trend, etc.	41	47.1%
Photo plots only	32	36.8%
Vegetation Compo-sition, using Dry-Weight, etc.	31	35.6%
Vigor, i.e. seed head production, reproductive tiller, adequate root development, etc.	26	29.9%
Seral Status, using Ecological Site Inventory (ESI)	25	28.7%

Type of Data Collected	Sum over MAs	Percent
Vegetation or plant community inventory and/or mapping	24	27.6%
Habitat Suitability or Quality Assessment (i.e. sensitive species habitat assessments)	19	21.8%
Production, using Double Weight Sampling, Harvest, Comparative Yield, etc. (not ESI)	18	20.7%
Habitat Mapping (i.e. shrub stands, suitable, marginal or unsuitable habitat)	18	20.7%
Density, using Quadrat, etc.	15	17.2%
Structure, using Robel Pole, Cover Board, Community Structure Analysis (CSA) etc.	14	16.1%
Current Vegetation Survey (CVS)	4	4.6%
Other: Fill in the blank	4	4.6%

Q6. What type of data is collected (by MA):

Riparian Example (2^{nd} highest frequency MA, n=61)

	q6a_67	q6a_67	q6a_67	q6a_67	q6a_67	q6a_67	q6a_73
Statistics	Functioning condition using Proper Functioning Condition (PFC)	Utilization, including herbaceous and/ or woody species using various techniques	Stream-bank Stability/ Alternation	Vegetation composition, using techniques such as Green Line, PachFish Indicator Biological Opinions (PIBO), Multiple Ind	Community Typing or Inventory, Pfister and Hansen, Ecological Site Inventory, Winward, etc.	Age Class, using aerial photos, etc.	Other
N	61	61	61	61	61	61	61
Aggregate							
Sum over MAs	53	41	33	31	10	7	10
Percent	0.87	0.67	0.54	0.51	0.16	0.11	0.16

Finding:

- **A wide range of data and methods are used across and within programs, e.g. 16 for range, 6 for riparian, 6 for animal population, 11 for forest, and 3 for invasives.**
- **What is the right mix of types of data collected by program, given the budget and current science? In range & riparian, most everybody is doing rangeland health. These two MA's are a large percentage of all monitoring activity. So, how can we more cost effectively collect that data?**

PEs reported for 5 most frequent MAs

(sorted by highest frequency Rangeland PEs)

Program Element (q8a1-39)	Rangeland/ Upland Habitat n=87	Riparian n=61	Animal Pop-ulation n=32	Forest/ Woodland Habitat n=32	Inva-sives n=27
MJ - Evaluate Rangeland Health	71%	23%	3%	9%	33%
ML - Monitor Grazing Allotments	66%	31%	3%	13%	30%
BP - Assess Watersheds	23%	20%		13%	7%
MQ - Monitor Terrestrial Habitat	18%	3%	22%	13%	4%
MO - Monitor Stream/Riparian Habitat	10%	52%	3%		7%
CB - Inventory Wildlife/Plan Habitat	10%	5%	28%	3%	4%
MX - Monitor Shrub/Grass Vegetation Treatments	10%	3%	3%		7%
BS - Inventory Presence of Invasive/Noxious Weeds	10%	2%		3%	67%
BR - Inventory Shrub/Grass/PJ Vegetation	9%			3%	7%
BV - Inventory Streams/Riparian Areas	8%	39%	6%		11%
MK - Evaluate Weed Treatments	7%	3%		3%	44%
BQ - Complete Ecological Site Inventory	7%	2%		6%	
MP - Monitor WHB HMAs nit	7%	2%			
MT - Monitor Fuels Treatment	6%		3%	3%	
MN - Monitor Lake/Wetland Habitat	5%	28%	3%		4%
MZ - Monitor Fire Rehab Treatments	5%	3%		3%	
MR - Monitor Species Populations	3%	5%	75%	6%	7%
DJ - Evaluate Land Use Plans	3%		3%		
BU - Inventory Lakes/Wetland Areas	2%	25%			
MU - Monitor Water Resources	2%	13%		0%	
BN - Inventory Water Resources	2%	10%	3%		
BO - Inventory Soil Resources	2%	2%			
MB - Evaluate Forest/Woodland Treatments	1%		3%	28%	7%
MC - Conduct Census of Wild Horse & Burro Areas	1%		3%		
MD - Monitor Wilderness and WSAs	1%				4%
BT - Inventory Forest/Woodland Vegetation	1%			25%	4%
BG - Assess Other Hazards (Non Hazmat or AML)		2%			

How well do PEs represent monitoring work performed? (q9a)

How well do these PEs represent the monitoring work performed?
(q9a. Scale: 1=Not at all well to 5=Very well)

Monitoring Activity	Mean	N	Percent Favorable
Wilderness/WSA, National Trails or Rivers	4.00	10	70.0
ESR or Restoration	3.85	13	69.2
Rangeland/Upland Habitat	3.41	85	50.6
Riparian	3.50	60	50.0
Special Status Plants	3.20	10	50.0
Invasives	3.35	26	46.2
Fire/Fuels	3.06	17	41.2
Aquatic Habitat	3.08	13	38.5
Recreation	3.00	13	38.5
Water Quality or Quantity	3.17	18	33.3
Animal Population	3.06	32	31.3
Lands or Minerals	2.70	10	20.0
Soil or Soil Biota	2.67	15	20.0
Climate	2.6	5	20.0
Travel & Transportation	2.77	13	15.4
Forest/Woodland Habitat	2.89	28	14.3
Air Quality	1.50	2	0.0

Finding:

- MEs report that PEs for 12 MAs don't represent the monitoring work very well (i.e. < 50% favorable)
- For two MAs, that PEs do not represent the work well is likely to provide an inaccurate sense of what is accomplished, as these are relatively high frequency MAs

Note:Full set of frequency distributions in appendix: q8&9 PEs 090706.xls

Which PEs need focus?

How well do these PEs represent the _______________ monitoring work performed?		
PE	no.	Mean (for those PE's with n ≥ 20; scale of 1 to 5=well)
MK - Evaluate Weed Treatments	22	3.77
MX - Monitor Shrub/Grass Vegetation Treatments	20	3.75
MT - Monitor Fuels Treatment	20	3.74
MO - Monitor Stream/Riparian Habitat	61	3.57
MN - Monitor Lake/Wetland Habitat	28	3.54
BS - Inventory for Presence of Invasive &/or Noxious Weeds	33	3.48
MJ - Evaluate Rangeland Health	96	3.43
ML - Monitor Grazing Allotments	101	3.42
BU - Inventory Lakes/Wetland Areas	20	3.40
MU - Monitor Water Resources	23	3.39
BV - Inventory Streams/Riparian Areas	47	3.34
BN - Inventory Water Resources	21	3.33
BP - Assess Watersheds	52	3.29
CB - Inventory Wildlife/Plan Habitat	28	3.22
MR - Monitor Species Populations	46	3.17
MQ - Monitor Terrestrial Habitat	36	3.06

Best represents work performed.

Finding:

Least represents work performed.

2. Why are we collecting those data?

- 3c & ME vs. 4, 10a-c, 11a, 12a, 13a-c, 29, 29a

2. Why are we collecting those data?

-- What drives monitoring? (q10a1-6)

- Across all MAs monitoring is driven in order by →
  - Tables on next slide shows detailed distributions for 3 most frequent MAs

Driver	Percent
Permits or other Use Authorizations	39%
Program direction	18%
Proj's not subject to permitting	17%
Resource Management Plan decision	15%
Court Order or Settlement Implementation	1%

- However, there are differences by MA.
  - E.g. for 6 most frequent MAs →
- Court orders have little direct impact as a driver of monitoring activity

Note: full table in appendix: q10 090706.xls

Monitoring Activity	Statistic	Permits or other Use Authorizations	Resource Management Plan decision	Proj's not subject to permitting	Program direction	Court Order or Settlement Implementation
Rangeland/Upland Habitat						
n=87	Mean	54.8	10.9	9.9	10.5	1.7
Riparian						
n=61	Mean	48.6	12.8	10.9	15.3	2.0
Animal Population						
n=32	Mean	31.9	17.3	10.1	29.5	1.0
Forest/Woodland Habitat						
n=32	Mean	31.1	18.9	18.8	13.4	2.2
Invasives						
n=27	Mean	19.0	14.9	12.4	24.0	0.4
Fire/Fuels						
n=21	Mean	14.7	16.6	26.1	23.3	0.2

Drivers of Monitoring Activity: Detailed tables (slide 1 of 2)

Monitoring Activity	Statistics	Drivers of Monitoring Activity (q10a_a_1-q10a_a_6) (Scale 0-100% per driver, sum to 100% across drivers)					
		10a1. Permits or other Use Authorizations	10a2. Resource Management Plan decision	10a3. Proj's not subject to permitting (inventory or monitoring for a restoration proj.)	10a4. Prog. direction (SSS, Wild-life, Fire/ Fuels, WH&B)	10a5. Court Order or Settlement Implementation	10a6. Other
Across 17 MAs	Grand Mean	38.99	14.67	16.72	17.67	1.33	2.99
Rangeland/Upland Habitat							
n=87	Mean	54.8	10.9	9.9	10.5	1.7	3.9
	Median	60	5	5	1	0	0
	Std. Deviation	32.02	15.56	14.50	17.92	4.24	16.22
	Skewness	-0.46	1.95	3.44	2.32	3.25	5.18
	Kurtosis	-0.96	4.34	17.41	5.67	12.07	28.13
	Minimum	0	0	0	0	0	0
	Maximum	100	80	100	90	25	100
Riparian							
n=61	Mean	48.6	12.8	10.9	15.3	2.0	2.4
	Median	50	5	10	5	0	0
	Std. Deviation	30.73	17.62	16.23	23.06	5.02	12.50
	Skewness	-0.19	1.97	3.38	1.96	3.10	6.28
	Kurtosis	-1.15	5.09	15.14	3.30	9.85	42.20
	Minimum	0	0	0	0	0	0
	Maximum	100	90	100	100	25	90
Animal Population							
n=32	Mean	31.9	17.3	10.1	29.5	1.0	3.9
	Median	25	7.5	7.5	20	0	0
	Std. Deviation	31.46	27.33	14.85	30.86	3.22	13.95
	Skewness	0.51	2.23	2.53	1.00	3.66	4.07
	Kurtosis	-1.25	4.43	6.82	-0.06	13.38	17.43
	Minimum	0	0	0	0	0	0
	Maximum	90	100	60	100	15	70

When “permits or other Use Authorizations” drove monitoring, the following activities most drives that monitoring? (q12a1-7)

Finding: Grazing permitting is the highest driver of MA. Thus, should we look to get it better funded? E.g. cost recovery…?

		Grazing	Fluid minerals	Special recreation permits	Lands & Realty actions	Timber sales	Solid minerals	Other
Monitoring Activity	**N**		**Means**					
Grand Mean		**0.37**	**0.18**	**0.15**	**0.14**	**0.12**	**0.09**	**0.17**
Rangeland/Upland Habitat	87	0.84	0.06	0.03	0.06	0.02	0.03	0.03
Riparian	61	0.75	0.11	0.10	0.10	0.13	0.08	0.07
Forest/Woodland Habitat	32	0.06	0.00	0.00	0.09	0.53	0.00	0.00
Animal Population	32	0.47	0.25	0.16	0.19	0.16	0.13	0.06
Invasives	27	0.44	0.07	0.07	0.11	0.04	0.07	0.15
Fire/Fuels	21	0.00	0.00	0.00	0.05	0.24	0.05	0.14
Water Quality or Quantity	18	0.50	0.39	0.17	0.22	0.28	0.17	0.17
Soil or Soil Biota	16	0.63	0.13	0.00	0.13	0.13	0.19	0.06
Recreation	15	0.07	0.00	0.87	0.20	0.00	0.00	0.33
Aquatic Habitat	14	0.71	0.21	0.07	0.14	0.29	0.07	0.07
Special Status Plants	14	0.36	0.29	0.14	0.57	0.21	0.14	0.00
ESR or Restoration	13	0.46	0.00	0.08	0.00	0.08	0.08	0.31
Travel & Transportation	13	0.00	0.15	0.46	0.08	0.08	0.00	0.38
Lands or Minerals	12	0.00	0.67	0.00	0.17	0.00	0.42	0.00
Wilderness/WSA/Nat'l Trails/Rivers	11	0.27	0.00	0.55	0.27	0.00	0.09	0.36
Climate	5	0.60	0.20	0.00	0.00	0.00	0.00	0.20
Air Quality	2	0.00	0.50	0.00	0.00	0.00	0.00	0.50
Other:	21	0.43	0.14	0.05	0.14	0.05	0.05	0.14

Legend: 🟧 = highest frequency 🟩 ≥20%

Which of the following most applies to the need for your monitoring data?

(q13a1-6)

		Data are needed:					
		to determine if management actions are having the desired effect, or if objectives are met	to authorize a use or issue a permit	to determine if estimated impacts were accurately projected in NEPA documentation	to determine if permit terms and conditions or stipulations are adhered to	as a foundation for an RMP or other plan	Other
Monitoring Activity	**N**	**Means (Scale: 1=least applicable, 5=most applicable)**					
Grand Mean ('other' excluded)		4.08	3.38	3.33	3.28	3.03	
Rangeland/Upland Habitat	76	4.42	4.09	3.11	3.95	3.30	5.00
Riparian	55	4.27	3.60	2.75	3.46	3.35	5.00
Animal Population	30	3.45	3.30	2.90	2.79	3.17	5.00
Forest/Woodland Habitat	25	4.04	2.79	3.32	3.30	3.08	5.00
Invasives	22	3.86	2.94	3.19	2.94	3.09	5.00
Water Quality or Quantity	16	3.75	3.44	3.27	3.40	3.69	4.50
Fire/Fuels	14	4.38	2.00	3.93	3.25	2.64	5.00
Aquatic Habitat	13	4.21	3.08	2.64	3.25	3.15	
Soil or Soil Biota	12	3.77	3.83	3.00	3.46	3.08	5.00
Special Status Plants	12	3.67	4.25	4.00	3.42	4.08	5.00
Recreation	11	4.07	3.47	3.13	3.73	3.55	5.00
Travel & Transportation	11	4.00	3.08	3.58	3.33	3.55	5.00
ESR or Restoration	10	4.69	2.27	2.92	2.22	2.60	1.00
Wilderness/WSA/Nat'l Trails/Rivers	8	4.30	2.67	3.75	3.56	4.13	
Lands or Minerals	7	3.90	3.92	3.73	4.00	2.71	
Climate	3	3.67	3.67	2.33	1.67	1.33	5.00
Air Quality	1	5.00	5.00	5.00	4.00	1.00	
Other:	15	3.75	4.17	3.00	3.24	3.80	5.00

Summary Finding On Why We Are Collecting Data

Finding:

- **The connection between data collection and land use planning efforts is unclear to many employees, perhaps because the connection of assessment activities to land use planning efforts is itself unclear. Specifically, 39% of all monitoring activities are driven by permitting or other use authorizations. In the two MAs that account for 35% of all MA (Range/Upland Health and Riparian) 55% and 49% of MAs are driven by permits.**
- **Further, much less of BLM's monitoring is driven by Resource Management Plan decisions (15%). When MEs are asked why monitoring data is most needed, RMPs are ranked lowest. (q13a1-6)**
- **As such, the local and program-specific nature of monitoring reduces the ability of BLM to accomplish more holistic land management and may lead to sub-optimized land management decisions.**

2. Why are we collecting those data?

q29. What percentage of your Office's monitoring activities are conducted according to a monitoring plan?:

Subsample						(Golf) Scale: 1>79%, 5<20%
Supervisor	**Alternative**	**Count**	**Percent**		**Statistic**	**Value**
	More than 79%	9	20.0		Mean	3.11
	60-79%	8	17.8		Median	3
	40-59%	7	15.6		Mode	4
	20-39%	11	24.4		Std. Deviation	1.47
	Less than 20%	10	22.2			
	Total	45	100			
Other	**Alternative**	**Count**	**Percent**		**Statistic**	**Value**
	More than 79%	6	21.4		Mean	3.43
	60-79%	2	7.1		Median	4
	40-59%	5	17.9		Mode	5
	20-39%	4	14.3		Std. Deviation	1.60
	Less than 20%	11	39.3			
	Total	28	100			
ME	**Alternative**	**Count**	**Percent**		**Statistic**	**Value**
	More than 79%	29	25.2		Mean	2.82
	60-79%	26	22.6		Median	3
	40-59%	19	16.5		Mode	1
	20-39%	19	16.5		Std. Deviation	1.47
	Less than 20%	22	19.1			
	Total	115	100			
Overall	**Alternative**	**Count**	**Percent**		**Statistic**	**Value**
	More than 79%	44	23.4		Mean	2.98
	60-79%	36	19.1		Median	3
	40-59%	31	16.5		Mode	1
	20-39%	34	18.1		Std. Deviation	1.5
	Less than 20%	43	22.9		Note: Bimodal	
	Total	188	100			

2. Why are we collecting those data?

q29a. Which of the following monitoring activities are covered by a monitoring plan?			Super-visor	Other	ME
Monitoring Activity	**Count**	**Percent (of 277)**	**Percent (of 58)**	**Percent (of 58)**	**Percent (of 161)**
Rangeland/Upland Habitat	136	49.1%	65.5	43.1	45.3
Riparian (lentic and lotic)	111	40.1%	56.9	34.5	36
Weeds	88	31.8%	51.7	25.9	26.7
Animal Population (vertebrate and invertebrate). Includes aquatic and terrestrial game and non-game, Survey and Manage, and Special Status, etc.	84	30.3%	48.3	25.9	25.5
Water Quality or Quantity	82	29.6%	46.6	32.8	22.4
Fire/Fuels	70	25.3%	41.4	20.7	21.1
Wilderness/WSA, National Trails or Rivers (includes wilderness, WSA, National Trails and/or Wild and Scenic Rivers)	58	20.9%	46.6	19	12.4
Aquatic Habitat n?	55	19.9%			
Special Status Plants (vascular and non-vascular). Includes Survey and Manage.	54	19.5%			
ESR or Restoration	53	19.1%			
Soil or Soil Biota	53	19.1%			
Forest/Woodland Habitat	47	17.0%			
Recreation (includes permitted and casual activities including dispersed, rivers, camping, climbing, caving, hunting, etc.)	47	17.0%			
Travel & Transportation (roads, primitive roads, and trails and related travel types)	38	13.7%			
Lands or Minerals	34	12.3%			
Air Quality	14	5.1%			
Climate	11	4.0%			

Finding:
Range and riparian are more likely to have a plan. 51%-96% of employees report *NO* plan.
Further, 55-88% MEs in high MA areas report *NO* plan.

3. How are data collected?

- 14-21a, 22a-c, 24aa-24cc,

3. How are data collected?

- What % of monitoring data are collected by: (q14a1-9)

- By far the greatest portion of monitoring data is colleted by permanent Ee's.
- Temp Ee's are a distant 2nd
  - Top 2 MAs completed by temps are:
    - ESR/Restoration
    - Aquatic Habitat

Monitoring Activity	N	Per-manent Ee's	Temporary Ee's (also 1039 or Term appointment)	BLM Con-tractor	Volun-teers	Agree-ments (e.g. Challenge Cost Share)	Part-ners	User or per-mittee	Other State or Federal agency	Other
		Means (Scale 0-100% per personnel category, sum to 100% across categories)								
Grand Mean (across 17 MAs)		60.1	18.6	6.4	1.2	2.0	1.7	2.0	2.3	1.2
Rangeland/Upland Habitat	87	56.5	21.8	8.8	0.5	1.3	0.7	2.0	1.0	1.4
Riparian	61	57.0	27.6	5.2	0.9	2.1	0.5	1.0	0.8	0.2
Forest/Woodland Habitat	32	49.1	24.5	12.0	0.0	3.1	0.3	0.0	0.0	4.7
Animal Population	32	44.5	13.2	11.0	4.9	4.7	5.7	0.9	14.1	0.9
Invasives	27	43.9	27.2	1.1	0.7	1.3	5.0	2.2	0.4	0.0
Fire/Fuels	21	46.7	24.3	4.8	0.0	2.4	0.0	0.0	0.0	12.4
Water Quality or Quantity	18	49.1	27.8	3.6	0.0	0.3	1.9	6.9	10.4	0.0
Soil or Soil Biota	16	74.6	11.6	10.6	0.9	0.0	0.3	1.1	0.9	0.0
Recreation	15	68.7	16.7	4.7	1.0	0.0	2.7	6.0	0.0	0.3
Aquatic Habitat	14	50.4	29.6	4.3	1.1	7.9	3.2	0.0	3.6	0.0
Special Status Plants	14	47.9	6.4	13.2	1.1	8.6	3.0	0.7	4.8	0.0
ESR or Restoration	13	63.8	30.0	3.1	0.0	0.0	2.3	0.8	0.0	0.0
Travel & Transportation	13									
Lands or Minerals	12									
Wilderness/WSA/Nat'l Trails/Rivers	11									
Climate	5									
Air Quality	2									
Other:	21									

Finding:
Who does the most partnering and contracting?
What can we learn from them? What mechanisms help this?
E.g. IDIQs and the E.C.O. organization. A few seasoned MEs swear by use of the contractors…

3. How are data collected?

q15a1. What percent of the data are collected through user or permittee contributed funds or through cost recovery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0%	295	71.3	78.9	78.9
	1 to 9%	29	7.0	7.8	86.6
	10 to 29%	30	7.2	8.0	94.7
	30 to 49%	4	1.0	1.1	95.7
	50 to 69%	6	1.4	1.6	97.3
	70 to 99%	6	1.4	1.6	98.9
	100%	4	1.0	1.1	100.0
	Total	374	90.3	100.0	
Missing	System	40	9.7		
Total		414	100.0		

What can be learned from those 30% who are using some cost recovery, e.g. O&G NEPA…

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For MA _____ what percent of the data are collected through user or permittee contributed funds or through cost recovery?

	q15a1 First Monitoring Activity						q15a2 Second Monitoring Activity					q15a3 Third Monitoring Activity					
OFFICE	1 to 9%	10 to 29%	30 to 49%	50 to 69%	70 to 99%	100 %	1 to 9%	10 to 29%	30 to 49%	50 to 69%	100 %	1 to 9%	10 to 29%	30 to 49%	50 to 69%	100 %	Total
Upper Snake FO	2	1			1			2		1			1				8
South River RA		1			1					2		1		1			6
Glenwood Springs FO		1			1			1	1				1				5
Ukiah FO		1			1		1	1				1					5
Buffalo FO	2						1	1									4
Kingman FO						1					1		1			1	4
Lake Havasu FO		1						2				1					4
Tucson FO					1			1					2				4
Bruneau FO	2						1										3
Grand Junction FO			1		1				1								3
Lewistown FO		1					1					1					3
Malheur RA	2	1															3
Mile City FO	1			1				1									3
Price FO		1											1			1	3
Roswell FO							1	2									3
Salmon FO	1						1					1					3
Anchorage FO	1						1										2
Battle Mountain FO								1					1				2
Gunnison FO				1				1									2
Kemmerer FO	1						1										2
Ashland RA		1															1
Bakersfield FO	1																1
Bishop FO	1																1
Glendale RA		1															1
Safford FO	1																1
Socorro FO							1										1
Table Total	**15**	**10**	**1**	**2**	**6**	**1**	**9**	**13**	**2**	**3**	**1**	**5**	**7**	**1**	**1**	**2**	**78**

NEW

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q15a1.What percent of the data are collected through user or permittee contributed funds or through cost recovery?

Monitoring Activity	1 to 9%	10 to 29%	30 to 49%	50 to 69%	70 to 99%	100%	Total
Rangeland/Upland Habitat	11	2			1		14
Animal Population	4	4		2			10
Invasives	2	6		1			9
Recreation	1	5	1		1	1	9
Forest/Woodland Habitat	2	2		1	1		6
Special Status Plants	1	3	1		1		6
Soil or Soil Biota	4						4
Lands or Minerals	2				1		3
Travel & Transportation		1	1	1			3
ESR or Restoration	1	1					2
Riparian	1	1					2
Wilderness/WSA, Nat'l Trails o		2					2
Fire/Fuels			1				1
Aquatic Habitat				1			1
Climate		1					1
Other:		2			1	3	6
Table Total	**29**	**30**	**4**	**6**	**6**	**4**	**79**

NEW

3. How are data collected?

-- How are monitoring data collected? (q16a1-4)

Method (select all that apply):	Percent (of 414 MAs)
Collected in the field	0.94
Remotely sensed	0.19
Modelled	0.08
Other	0.01

Remotely sensed (e.g. color infrared, true color, etc.)?			
Monitoring Activity	Remotely Sensed	Out of:	Percent
Forest/Woodland Habitat	12	32	37.5
Rangeland/Upland Habitat	23	87	26.4
Lands or Minerals	3	12	25.0
ESR or Restoration	3	13	23.1
Riparian	14	61	23.0
Animal Population	7	32	21.9
Soil or Soil Biota	3	16	18.8
Invasives	5	27	18.5
Fire/Fuels	3	21	14.3
Travel & Transportation	1	13	7.7
Aquatic Habitat	1	14	7.1
Recreation	1	15	6.7
Water Quality or Quantity	1	18	5.6

Finding:
Part 1: R&D is needed on range and riparian to help with remote sensing to get better economies of scale on the two big MAs.

3. How are data collected?

-- Means by which monitoring data are initially recorded in the field (q17a_a_1-3)

q17a_a_1. Which of the following best represents the means by which monitoring data are collected?		
Method:	Count	Percent
Hard copy notation (e.g. recorded on paper)	305	78.0
Electronic (e.g. PDA, laptop, notebook, GPS)	71	18.2
Other, please specify	15	3.8
Total	391	100

q17a_a_1. Method: Electronically collected in field			
Monitoring Activity	N	Out of:	Percent
Travel & Transportation	10	12	83.3
Invasives	10	23	43.5
Water Quality or Quantity	6	17	35.3
Animal Population	9	32	28.1
Forest/Woodland Habitat	7	29	24.1
Recreation	3	14	21.4
Lands or Minerals	2	10	20.0
Wilderness/WSA/Nat'l Trails/Rivers	2	11	18.2
Fire/Fuels	3	19	15.8
Riparian	6	59	10.2
Rangeland/Upland Habitat	7	83	8.4
Aquatic Habitat	1	13	7.7
Special Status Plants	1	13	7.7
Note: MAs with no electronic collection & Climate (n=2) & Other excluded.			

Finding:
Part 2: Further, electronic data collection in the field is very low in the two biggest MAs.

3. How are data collected?

-- Supervision, training, guidance, following guidance (q18-q21)

Percent Favorable

- Supervision 48% (q18)
- Training 78% (q19)
- Guidance 72% (q20)
- Following guidance 72% (q21)

Finding:
Within training and guidance, which are fairly actionable, certain MAs are likely to have better or worse showing on percent favorable, i.e. some are best practices and some need help. To determine which are which is a data gap.

q18. How often are monitoring data reviewed by a peer or supervisor prior to use in a document?

Scale	Count	Percent
1 Never	41	10.8
2	73	19.3
3	82	21.7
4	78	20.6
5 Always	104	27.5
Total	378	100

q19. How well are individuals who collect monitoring data trained on techniques & protocols for data collection?

Scale	Count	Percent
1 Not very well	7	1.8
2	20	5.1
3	61	15.6
4	134	34.4
5 Very well	168	43.1
Total	390	100

q20. Is there sufficient guidance (Tech. Ref's, Handbooks, Manuals, IMs) to ensure that monitoring data are collected in accordance with Bureau protocols?

Scale	Count	Percent
1 Insufficient	18	5.0
2	29	8.1
3	53	14.8
4	93	26.0
5 Sufficient	165	46.1
Total	358	100

q21. How often is guidance (Technical References, Handbooks, Manuals, IMs) followed when collecting data?

Scale	Count	Percent
1 Never	6	1.6
2	30	8.2
3	66	18.0
4	124	33.9
5 Always	140	38.3
Total	366	100

q18. How often are monitoring data reviewed by a peer or supervisor prior to use in a document?

Monitoring Activity	Never 1	2	3	4	Always 5	Total	Percent = "1" or "2"
Air Quality	1		1			2	50%
Soil or Soil Biota	2	5	3	3	2	15	47%
Animal Population	4	10	6	6	5	31	45%
Riparian	5	16	11	10	16	58	36%
Forest/Woodland Habitat	3	7	3	9	6	28	36%
ESR or Restoration	1	3	3	2	3	12	33%
Rangeland/Upland Habitat	6	19	12	15	31	83	30%
Recreation	3	1	4	3	4	15	27%
Invasives	4	1	4	5	7	21	24%
Climate		1	2	1	1	5	20%
Lands or Minerals		2	3	3	2	10	20%
Fire/Fuels	1	2	4	4	5	16	19%
Special Status Plants	1	1	6	1	2	11	18%
Wilderness/WSA, Nat'l Trails or Rivers	2		2	3	4	11	18%
Aquatic Habitat	1	1	7	3	2	14	14%
Water Quality or Quantity	1	1	3	6	5	16	13%
Travel & Transportation	1		3	3	6	13	8%
Other:	5	3	5	1	3	17	
Table Total	**41**	**73**	**82**	**78**	**104**	**378**	

NEW

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q19. How well are individuals who collect monitoring data trained on techniques and protocols for data collection?

Monitoring Activity	Not very well=1	2	3	4	Very Well=5	Total	Percent = "1" or "2"
Air Quality	1		1			2	50%
Lands or Minerals	1	2	2	2	4	11	27%
Climate		1	1		3	5	20%
Recreation		3	2	6	4	15	20%
Soil or Soil Biota		3	2	5	6	16	19%
Special Status Plants	1		1	2	7	11	9%
Wilderness/WSA, National Trails or Rive		1	2	3	5	11	9%
Travel & Transportation		1	2	5	5	13	8%
Forest/Woodland Habitat	1	1	6	9	12	29	7%
Animal Population		2	3	8	19	32	6%
Fire/Fuels	1		6	3	8	18	6%
Water Quality or Quantity	1		1	6	10	18	6%
Riparian	1	2	8	29	20	60	5%
Rangeland/Upland Habitat		4	15	30	34	83	5%
Invasives			1	8	13	22	0%
ESR or Restoration			4	6	3	13	0%
Aquatic Habitat			1	8	5	14	0%
Other:			3	4	10	17	
Table Total	**7**	**20**	**61**	**134**	**168**	**390**	

NEW

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q20. Is there sufficient guidance (Technical References, Handbooks, Manuals, IMs) to ensure that data are collected in line with Bureau protocols?

Monitoring Activity	Insufficient 1	2	3	4	Sufficient 5	Total	Percent = "1" or "2"
Air Quality	1					1	100%
Travel & Transportation	2	2	2	1	1	8	50%
Recreation	1	2		4	4	11	27%
Fire/Fuels	2	2	3		8	15	27%
Special Status Plants		3	3	3	3	12	25%
Animal Population	2	5	7	7	8	29	24%
Forest/Woodland Habitat	2	4	5	7	9	27	22%
Wilderness/WSA, Nat'l Trails or Rivers	1	1		2	5	9	22%
Aquatic Habitat	1	2		8	3	14	21%
Lands or Minerals		2	2	2	4	10	20%
Water Quality or Quantity	3		1	6	6	16	19%
ESR or Restoration	1		3	2	6	12	8%
Soil or Soil Biota		1	5	2	6	14	7%
Invasives		1	1	7	10	19	5%
Riparian		3	7	20	27	57	5%
Rangeland/Upland Habitat	2	1	11	18	50	82	4%
Climate				1	2	3	0%
Other:			3	3	13	19	
Table Total	**18**	**29**	**53**	**93**	**165**	**358**	

NEW

q21. How often is guidance (Technical References, Handbooks, Manuals, Ims) followed when collecting data?

Monitoring Activity	Never 1	2	3	4	Always 5	Total	Percent = "1" or "2"
Fire/Fuels		3	3	2	7	15	20%
Animal Population	2	4	3	6	15	30	20%
Soil or Soil Biota		3	3	5	5	16	19%
Aquatic Habitat		2	3	4	4	13	15%
Travel & Transportation	1		3	3	1	8	13%
Water Quality or Quantity		2	2	5	8	17	12%
Forest/Woodland Habitat		3	4	7	12	26	12%
Invasives		2	2	6	9	19	11%
Lands or Minerals		1	4	3	2	10	10%
Riparian	1	4	8	22	24	59	8%
ESR or Restoration	1		3	6	2	12	8%
Special Status Plants		1	3	3	5	12	8%
Rangeland/Upland Habitat	1	5	13	31	32	82	7%
Air Quality			2			2	0%
Climate			1	4		5	0%
Recreation			3	4	4	11	0%
Wilderness/WSA, Nat'l Trails or Rive			2	3	4	9	0%
Other:			4	10	6	20	
Table Total	**6**	**30**	**66**	**124**	**140**	**366**	

NEW

3. How are data collected?

- Q24aaa. **How often are monitoring activities based on an ecological model (description of the relationship between species biology and management activities)?**
  - ***On a scale from 1=Never to 5=Always, across 339 MAs rated, 63% of MEs said 3 or higher (i.e. sometimes, usually or always) [mean=2.87]***
    - *There is some variation by MA. E.g. for MEs who picked Rangeland/Upland Health as one of their top 3 MAs, 78% said 3 or higher (n=78).*

Finding:
37% don't have an ecological model.

q24aaa. How often are monitoring activities based on an ecological model

NEW **Travel, Recreation and Wilderness are not based on an ecological model with 4 additional greater than 50%**

Monitoring Activity	0 = Seldom or Never	1 = Sometimes, Usually or Always	Total	Percent "0"
Recreation	7	1	8	88%
Travel & Transportation	7	1	8	88%
Wilderness/WSA, Nat'l Trails or Rivers	6	1	7	86%
Lands or Minerals	5	2	7	71%
Climate	3	2	5	60%
Special Status Plants	4	4	8	50%
Air Quality	1	1	2	50%
Water Quality or Quantity	7	8	15	47%
Invasives	8	12	20	40%
ESR or Restoration	4	8	12	33%
Animal Population	9	20	29	31%
Aquatic Habitat	4	9	13	31%
Riparian	14	41	55	25%
Rangeland/Upland Habitat	17	61	78	22%
Soil or Soil Biota	3	11	14	21%
Forest/Woodland Habitat	5	23	28	18%
Fire/Fuels	1	15	16	6%
Other:	12	2	14	
Table Total	**117**	**222**	**339**	

Office	0 = Seldom or Never	1 = Sometimes, Usually or Always	Total	Percent "0"
Artic FO	8		8	100%
Price FO	6		6	100%
Salt Lake FO	2		2	100%
Buffalo FO	12	4	16	75%
Alturas FO	6	3	9	67%
Elko FO	3	2	5	60%
Tucson FO	6	4	10	60%
Kingman FO	7	5	13	54%
Battle Mountain FO	5	2	10	50%
Lake Havasu FO	8	2	16	50%
Lewistown FO	4	5	9	44%
Grand Junction FO	3	2	9	33%
Gunnison FO	3	6	9	33%
Ukiah FO	3	4	10	30%
Bruneau FO	3	7	12	25%
Malheur RA	6	13	25	24%
Upper Snake FO	7	16	30	23%
Kemmerer FO	2	8	10	20%
Glendale RA	3	7	16	19%
Ely FO	1	5	6	17%
Klamath Falls RA	2	10	12	17%
Medford DO	1	2	6	17%
Ashland RA	5	23	34	15%
Bishop FO	1	5	7	14%
Safford FO	2	12	16	13%
Socorro FO	1	7	8	13%
Glenwood Springs FO	2	8	18	11%
Anchorage FO	1	9	10	10%
South River RA	1	12	15	7%
Bakersfield FO		3	3	0%
Little Snake FO		3	3	0%
Mile City FO		18	22	0%
Newcastle FO		3	3	0%
Roswell FO		7	14	0%
Salmon FO		5	9	0%
Table Total	**117**	**222**	**411**	

3. How are data collected?

E.g. Rangeland Monitoring

Q22a. Are monitoring data collected with techniques that are consistent enough over time so that a meaningful trend can be identified?

q22.	Aggregate	
	Count	Percent
Yes	68	84.0%
No	13	16.0%
Total	81	

Q24a. Are monitoring data collected often enough to identify meaningful trends and support decisions?

q24a.	Aggregate	
	Count	Percent
Yes	53	67.1%
No	26	32.9%
Total	79	

Q24aaa. How often are monitoring activities based on an ecological model (description of the relationship between species biology and management activities)?

q24aaa.	Aggregate	
	Count	Percent
Never 1	7	9.0%
2	10	12.8%
3	25	32.1%
4	29	37.2%
Always 5	7	9.0%
Total	78	

q22a1. Are monitoring data collected with techniques that are consistent enough over time so that a meaningful trend can be identified?

NEW

Monitoring Activity	Yes	No	Total	Percent "No"
Special Status Plants	7	5	14	36%
Recreation	9	4	15	27%
Soil or Soil Biota	10	4	16	25%
Climate	4	1	5	20%
Lands or Minerals	9	2	12	17%
Rangeland/Upland Habitat	68	13	87	15%
Forest/Woodland Habitat	27	4	32	13%
Riparian	52	6	61	10%
Animal Population	28	3	32	9%
Travel & Transportation	11	1	13	8%
Aquatic Habitat	13	1	14	7%
Water Quality or Quantity	16	1	18	6%
Fire/Fuels	18	1	21	5%
Invasives	21	1	27	4%
ESR or Restoration	13		13	
Air Quality	2		2	
Wilderness/WSA, Nat'l Trails or Rive	9		11	
Other:	13	3	21	
Total	**330**	**50**	**414**	

39

Office	Yes	No	Total	Percent "No"
Elko FO	2	3	5	60%
Glenwood Springs FO	9	7	18	39%
Socorro FO	5	3	8	38%
Little Snake FO	2	1	3	33%
Price FO	4	2	6	33%
Safford FO	11	5	16	31%
Ukiah FO	7	3	10	30%
Bruneau FO	8	3	12	25%
Alturas FO	7	2	9	22%
Anchorage FO	8	2	10	20%
Lake Havasu FO	10	3	16	19%
Kingman FO	8	2	13	15%
Mile City FO	18	3	22	14%
Buffalo FO	14	2	16	13%
Grand Junction FO	7	1	9	11%
Battle Mountain FO	8	1	10	10%
Tucson FO	9	1	10	10%
Ashland RA	31	3	34	9%
Klamath Falls RA	11	1	12	8%
Malheur RA	20	2	25	8%
Artic FO	5		8	0%
Bakersfield FO	3		3	0%
Bishop FO	7		7	0%
Ely FO	6		6	0%
Glendale RA	12		16	0%
Gunnison FO	9		9	0%
Kemmerer FO	10		10	0%
Lewistown FO	6		9	0%
Newcastle FO	3		3	0%
Roswell FO	10		14	0%
Salmon FO	9		9	0%
Salt Lake FO	2		2	0%
South River RA	15		15	0%
Upper Snake FO	25		30	0%
Medford DO	6		6	0%
Total	**327**	**50**	**411**	

q24a1. Are monitoring data collected often enough to identify meaningful trends and support decisions?

40

Monitoring Activity	Yes	No	Total	Percent "No"
Special Status Plants	3	8	14	57%
Air Quality	1	1	2	50%
Soil or Soil Biota	7	6	16	38%
Animal Population	19	12	32	38%
Rangeland/Upland Habitat	53	26	87	30%
Forest/Woodland Habitat	20	9	32	28%
Riparian	41	17	61	28%
Water Quality or Quantity	11	5	18	28%
Wilderness/WSA, Nat'l Trails or Rivers	7	3	11	27%
Recreation	9	4	15	27%
Lands or Minerals	8	3	12	25%
Fire/Fuels	12	5	21	24%
Travel & Transportation	9	3	13	23%
Aquatic Habitat	11	3	14	21%
Invasives	18	5	27	19%
ESR or Restoration	10	2	13	15%
Climate	5		5	0%
Other:	15	5	21	
Total	**259**	**117**	**414**	

NEW

Office	Yes	No	Total	Percent "No"
Price FO	2	4	6	67%
Elko FO	2	3	5	60%
Alturas FO	4	5	9	56%
Battle Mountain FO	4	5	10	50%
Buffalo FO	8	8	16	50%
Glenwood Springs FO	9	9	18	50%
Safford FO	8	8	16	50%
Ashland RA	14	16	34	47%
Malheur RA	12	11	25	44%
Lake Havasu FO	5	7	16	44%
Bruneau FO	6	5	12	42%
Anchorage FO	6	4	10	40%
Ukiah FO	6	4	10	40%
Socorro FO	5	3	8	38%
Little Snake FO	2	1	3	33%
Mile City FO	14	7	22	32%
Klamath Falls RA	9	3	12	25%
Kingman FO	10	3	13	23%
Lewistown FO	3	2	9	22%
South River RA	13	2	15	13%
Artic FO	4	1	8	13%
Grand Junction FO	7	1	9	11%
Gunnison FO	8	1	9	11%
Tucson FO	9	1	10	10%
Bakersfield FO	3		3	0%
Bishop FO	7		7	0%
Ely FO	6		6	0%
Glendale RA	10		16	0%
Kemmerer FO	10		10	0%
Newcastle FO	3		3	0%
Roswell FO	9		14	0%
Salmon FO	9		9	0%
Salt Lake FO	2		2	0%
Upper Snake FO	24		30	0%
Medford DO	6		6	0%
Total	**259**	**117**	**411**	

62 comments explain why MEs some believe monitoring data are not collected often enough to identify meaningful trends & support decisions. (q24aa)

N	Per-cent	Comment Category	Sample Comment
44	71%	Lack of Funding, Resources or Staff	Funding and personnel preclude being able to collect data as often as needed to determine trend. Often, many factors influence the trend, and data collected is unable to determine the causal factors.
10	16%	Insufficient or Changing Standards and Procedures	Techniques of data collection have been different over the years and don't allow for direct comparison to each other to determine trend. Data has often times only been collected once or twice on and allotment since the 70's or 80's and there is a large gap until recently when data has been collected again. This is a huge problem to me. Unless data is collect in the same place, the same way, and often, then it cannot be used to determine a trend.
7	11%	Data Collected Sporadically	Animal population data is usually collected sporadically and not in enough frequency.
6	10%	Other	Plant community data gathered as part of a 5 years study, but more time would be needed to see how plant communities change.

4. How are data stored and analyzed?

25-27a-c

4. How are monitoring data stored or managed? (q25a_a_1)

Monitoring Activity	N	Hard copy (e.g. paper files, mylar)	COTS spread-sheet/ data-base (e.g. Excel, Access, etc.)	Com-mercial GIS (e.g. ArcInfo, etc.)	Field or District Office developed app's	BLM Nat'l app's (e.g. ESR data-base, etc.)	State Office developed app's (e.g. VMAP, ISMS, etc.)	Other Fed. or State agencies developed app's (e.g. Nat'l Hydrography Dataset, Aquatic Resources Info System, NRCS Web Soil Survey)	Com-mercial statistical software (e.g. SPSS, etc.)	Other
		Percent								
Grand Mean (Percent Across MAs)		85%	57%	55%	24%	9%	8%	8%	4%	4%
Soil or Soil Biota	16	88%	50%	44%	13%	0%	0%	0%	6%	6%
Rangeland/Upland Habitat	87	93%	53%	55%	16%	3%	9%	8%	11%	2%
Forest/Woodland Habitat	32	91%	59%	59%	28%	13%	13%	3%	13%	13%
Fire/Fuels	21	86%	48%	57%	29%	19%	5%	10%	14%	5%
Invasives	27	74%	41%	70%	26%	15%	7%	7%	4%	4%
ESR or Restoration	13	100%	69%	46%	15%	15%	0%	8%	8%	8%
Riparian	61	90%	61%	62%	21%	5%	7%	10%	2%	5%
Aquatic Habitat	14	93%	86%	79%	29%	0%	7%	0%	0%	0%
Water Quality or Quantity	18	83%	83%	67%	39%	6%	0%			
Special Status Plants	14	79%	57%	71%	29%	7%	14%			
Animal Population	32	91%	78%	84%	31%	9%	19%			
Air Quality	2	50%	50%	0%	0%	0%	50%			
Climate	5	100%	60%	0%	20%	0%	0%			
Lands or Minerals	12	92%	58%	75%	33%	8%	8%			
Recreation	15	93%	53%	60%	13%	27%	7%			
Travel & Transportation	13	62%	46%	69%	46%	23%	0%			
Wilderness/WSA/ Nat'l Trails/Rivers	11	73%	45%	64%	18%	9%	0%			
Other:	21	86%	29%	33%	19%	0%	0%			

Finding:
80% of data is not collected electronically. So, to get 57% COTS and 24% FO app's data requires transcription.
This greatly hampers use at a level above the FO. Big opportunity here…

4. How are data stored and analyzed?

Specific questions about GIS (q26 & q27)

q26a1. How much of the monitoring data can be linked to GIS?			
Coding	Scale	Count	Percent
1	Almost all of the data	123	32%
2	Most of the data	97	25%
3	Some of the data	115	30%
4	Little of the data	38	10%
5	None of the data	14	4%
	Total	387	

Mean = 2.29

q27a1. Of the monitoring data collected to date which is appropriate for GIS, how much is currently in GIS?			
Coding	Scale	Count	Percent
1	More than 79%	82	22%
2	60-79%	68	18%
3	40-59%	55	15%
4	20-39%	67	18%
5	Less than 20%	107	28%
	Total	379	

Mean=3.14

Finding:

While on average about 57% of the data can be linked to GIS, on average only about 40% of it is.

Some MAs are likely to be best practices or need help with regard to linkage to GIS…

5. How, and by whom, are the data being used?

- In particular, does analysis of the data lead to management recommendations and does it help the BLM understand conditions and trends?

5. How, and by whom, are the data being used?

q28a1. How effectively do the data allow you to describe current existing condition of the land?			
Coding	Scale	Count	Percent
1	1 Very Ineffectively	10	3%
2	2	45	12%
3	3	108	28%
4	4	132	34%
5	5 Very Effectively	88	23%
	Total	383	

q28a2. How effectively do your monitoring data explain changes in resource condition or trend?			
Coding	Scale	Count	Percent
1	1 Very Ineffectively	15	4%
2	2	65	17%
3	3	120	32%
4	4	113	30%
5	5 Very Effectively	60	16%
	Total	373	

q28a3. How effectively are trends in resource condition correlated with management actions actions (e.g. stream conditions improve with improved grazing practices)?			
Coding	Scale	Count	Percent
1	1 Very Ineffectively	22	6%
2	2	60	17%
3	3	115	33%
4	4	106	31%
5	5 Very Effectively	44	13%
	Total	347	

- 44%-57% of MAs have data that are effective or very effective in:
  - Describing existing conditions (57% favorable)
  - Explaining changes in resource conditions or trend (46% favorable)
  - Correlating trends in resource conditions with management actions (44% favorable)
- However…(see next slide)

5. How, and by whom, are the data being used?

q28a4. How effectively do multiple programs use the same monitoring data?			
Coding	Scale	Count	Percent
1	1 Very Ineffectively	59	17%
2	2	100	29%
3	3	91	26%
4	4	69	20%
5	5 Very Effectively	28	8%
	Total	347	

q28a5. How effectively are data aggregated to multiple levels (e.g. across allotments, Planning Units, Field Offices, geo. Regions)?			
Coding	Scale	Count	Percent
1	1 Very Ineffectively	56	17%
2	2	85	26%
3	3	95	29%
4	4	65	20%
5	5 Very Effectively	22	7%
	Total	323	

- ***Finding***: However, the same data are only 27% to 28% effective or very effective in:
  - serving across programs (28% favorable), or
  - at various aggregated levels (27% favorable).

Confound in data:
Since inventories are not about trends, some of the findings on this slide and previous one need to be qualified.

5. How, and by whom, are the data being used?

	q28a. How effectively:									
Scale: 1=Very ineffectively to 5=Very effectively	do the data allow you to describe current existing condition of the land?		do your monitoring data explain changes in resource condition or trend?		are trends in resource condition correlated with management actions (e.g. stream conditions improve with improved grazing practices)?		do multiple programs use the same monitoring data?		are data aggregated to multiple levels (e.g. across allotments, Planning Units, Field Offices, geographic regions)?	
Monitoring Activity	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**
Rangeland/Upland Habitat	82	3.84	82	3.57	79	3.53	78	2.63	71	2.63
Riparian	58	3.86	57	3.65	56	3.63	56	3.04	54	2.91
Animal Population	30	3.53	31	3.23	29	2.93	28	3.00	27	2.78
Forest/Woodland Habitat	28	3.64	28	3.29	24	3.25	25	2.28	23	2.61
Invasives	22	3.36	22	3.27	22	3.09	21	3.19	16	3.19
Fire/Fuels	19	3.84	18	3.61	17	3.47	17	2.71	13	2.46
Water Quality or Quantity	17	3.35	17	3.12	15	2.60	16	2.44	15	2.47
Soil or Soil Biota	15	3.73	13	3.08	13	3.38	13	2.77	13	3.23
Recreation	15	3.33	14	3.21	10	3.30	10	2.60	12	2.83
Aquatic Habitat	14	3.29	13	2.77	12	2.50	14	2.71	12	2.42
ESR or Restoration	13	3.92	13	3.62	13	3.15	12	3.42	10	2.90
Special Status Plants	13	2.92	12	2.33	11	2.55	12	2.50	11	2.73
Travel & Transportation	12	3.50	11	3.09	9	2.89	10	3.10	11	2.91
Lands or Minerals	11	3.27	11	3.00	6	3.33	7	2.86	7	2.14
Wilderness/WSA/Nat'l Trails/Rivers	10	3.30	9	3.11	9	2.89	7	2.14	8	2.50
Climate	5	4.00	5	4.00	4	3.75	5	2.60	5	3.20
Air Quality	2	2.50	2	3.00	2	2.00	2	2.00	2	2.00
Other:	17	3.76	15	3.80	16	3.31	14	1.86	13	2.38

▨ = when n>10, lowest mean in column or mean less than or equal to 2.50

5. How, and by whom, are the data being used?

q31. How often are monitoring activities coordinated among the different programs in your office? (e.g. range & wildlife studies are coordinated)?		
Scale	**Count**	**Percent**
1 Never	20	7.5
2	78	29.2
3	100	37.5
4	56	21.0
5 Always	13	4.9
Total	267	100

q34. How often are the results of monitoring analysis data summarized in a written report?		
Scale	**Count**	**Percent**
1 Never	10	3.7
2	54	20.2
3	80	30.0
4	82	30.7
5 Always	41	15.4
Total	267	100

q34a. How often are monitoring data shared with the public?		
Scale	**Count**	**Percent**
1 Never	15	5.6
2	95	35.7
3	87	32.7
4	47	17.7
5 Always	22	8.3
Total	266	100

Percent Favorable:

- Q31. MAs are coordinated across programs in FO 26%
- Q34. Data are summarized in a written report 46%
- Q34a. Data are shared with the public 26%

Finding:

- **Little (26%) data are effective in serving across programs or at an aggregated level above FOs (from earlier slide).**
- **Data are seldom coordinated (74% unfavorable), seldom reported (54% unfavorable), and seldom shared with the public (74% unfavorable, q34a).**

However, it is likely that some MAs are best practices and some are in need of help relative to these questions. This can be determined with the available data.

Coordination across programs (by MA & by FO)

NEW

q31. How often are monitoring activities coordinated among the different programs in your office? (E.g., range and wildlife studies are coordinated)?							
Monitoring Activity	Never 1	2	3	4	Always 5	Total	Percent "Seldom or Never"
Lands or Minerals	3	6			1	10	90%
Air Quality	1	0			1	2	50%
Special Status Plants	0	6	6	1		13	46%
Forest/Woodland Habitat	2	10	16	1		29	41%
Animal Population	3	9	10	8	2	32	38%
Water Quality or Quantity	5	1	7	5		18	33%
Travel & Transportation	2	2	6	2		12	33%
Riparian	4	15	23	15	3	60	32%
Soil or Soil Biota	0	5	5	5	1	16	31%
ESR or Restoration	1	3	4	4	1	13	31%
Recreation	1	3	6	3	1	14	29%
Aquatic Habitat	2	2	6	4		14	29%
Fire/Fuels	1	4	8	4	1	18	28%
Rangeland/Upland Habitat	2	20	33	24	6	85	26%
Invasives	0	6	11	6	2	25	24%
Wilderness/WSA, Nat'l Trails or Riv	1	1	6	2		10	20%
Climate	1	0	1	1	2	5	20%
Other:	3	9	5	3		20	60%
Table Total	**32**	**102**	**153**	**88**	**21**	**396**	

q31. How often are monitoring activities coordinated among the different programs in your office? (E.g., range and wildlife studies are coordinated)?							
OFFICE	Never 1	2	3	4	Always5	Total	Percent "Seldom or Never"
Alturas FO		9				9	100%
Little Snake FO		3				3	100%
Price FO	3	3				6	100%
Buffalo FO	3	9	2			14	86%
Lake Havasu FO	8	5	3			16	81%
Safford FO	3	9	3			15	80%
Artic FO	3	3	2			8	75%
Elko FO		3	2			5	60%
South River RA		9	6			15	60%
Ely FO		3		3		6	50%
Medford DO		3	3			6	50%
Mile City FO	3	6	13			22	41%
Tucson FO		4	3	3		10	40%
Glendale RA		4	3	4		11	36%
Gunnison FO		3	3	3		9	33%
Anchorage FO	3		4		3	10	30%
Ukiah FO		3	6	1		10	30%
Ashland RA	4	5	13	6	3	31	29%
Bruneau FO		3	5	4		12	25%
Klamath Falls RA		3	9			12	25%
Malheur RA		6	5	11	3	25	24%
Glenwood Springs FO		3	8	3		14	21%
Kemmerer FO		2	8			10	20%
Bishop FO	1			6		7	14%
Battle Mountain FO	1		2	4	3	10	10%
Kingman FO		1	9		3	13	8%
			3			3	0%
Bakersfield FO				3		3	0%
Grand Junction FO			6	3		9	0%
Lewistown FO			3	6		9	0%
Newcastle FO			3			3	0%
Roswell FO			4	7		11	0%
Salmon FO				3	6	9	0%
Salt Lake FO			2			2	0%
Socorro FO			8			8	0%
Upper Snake FO			12	18		30	0%
Total	**32**	**102**	**153**	**88**	**21**	**396**	

Summarization of monitoring analysis in written report (by MA & by FO)

NEW

q34. How often are the results of monitoring analysis data summarized in a written report?

Monitoring Activity	Never 1	2	3	4	Always 5	Total	Percent "Seldom or Never"
Air Quality		1	1			2	50%
Travel & Transportation	1	3	7	1	1	13	31%
Lands or Minerals	2	1	1	1	5	10	30%
Special Status Plants		4	3	6	1	14	29%
Water Quality or Quantity	2	3	5	7	1	18	28%
Wilderness/WSA, Nat'l Trails or Rivers		3	5	1	2	11	27%
ESR or Restoration		3	2	6	2	13	23%
Animal Population		7	9	13	3	32	22%
Riparian		13	23	21	3	60	22%
Recreation		3	6	2	3	14	21%
Soil or Soil Biota		3	6	2	5	16	19%
Rangeland/Upland Habitat	1	12	29	31	13	86	15%
Aquatic Habitat		2	5	6	1	14	14%
Invasives		3	5	13	3	24	13%
Fire/Fuels		2	8	6	3	19	11%
Forest/Woodland Habitat		2	9	13	5	29	7%
Climate			4		1	5	0%
Other:	2		4	4	7	17	12%
Table Total	**8**	**65**	**132**	**133**	**59**	**397**	

q34. How often are the results of monitoring analysis data summarized in a written report?

OFFICE	Never 1	2	3	4	Always 5	Total	Percent "Seldom or Never"
Lake Havasu FO	2	9		3		14	79%
Alturas FO		6			3	9	67%
Ely FO		3		3		6	50%
Price FO		3		3		6	50%
Medford DO		3	3			6	50%
Bishop FO		3	4			7	43%
Buffalo FO	3	3	6		2	14	43%
Mile City FO		9	11	2		22	41%
Tucson FO	1	3	3	3		10	40%
Lewistown FO		3	3	3		9	33%
Anchorage FO		3	3	3	1	10	30%
Ukiah FO		3		1	6	10	30%
Glenwood Springs FO	2	3	9	4		18	28%
Kingman FO		3	6		4	13	23%
Malheur RA		5		11	9	25	20%
Bruneau FO		2	2	3	5	12	17%
Ashland RA		1	18	12	3	34	3%
			3			3	0%
Artic FO			3	5		8	0%
Bakersfield FO				3		3	0%
Battle Mountain FO				8	1	9	0%
Elko FO				2		2	0%
Glendale RA			2	6	2	10	0%
Grand Junction FO			6	3		9	0%
Gunnison FO			6		3	9	0%
Kemmerer FO			7	3		10	0%
Klamath Falls RA			3	9		12	0%
Little Snake FO			3			3	0%
Newcastle FO				3		3	0%
Roswell FO			2	4	5	11	0%
Safford FO			6	6	4	16	0%
Salmon FO			3	6		9	0%
Salt Lake FO				2		2	0%
Socorro FO			6	2		8	0%
South River RA				12	3	15	0%
Upper Snake FO			14	8	8	30	0%
Total	**8**	**65**	**132**	**133**	**59**	**397**	

Sharing Monitoring Data with Public (by MA & by FO)

NEW

q34a. How often are monitoring data shared with the public?

Monitoring Activity	Never 1	2	3	4	Always 5	Total	Percent "Seldom or Never"
Special Status Plants		9	3	2		14	64%
Lands or Minerals	2	3	2	2		9	56%
Air Quality		1	1			2	50%
Fire/Fuels	1	8	9	1	1	20	45%
Aquatic Habitat		6	5	3		14	43%
Water Quality or Quantity	1	6	5	6		18	39%
ESR or Restoration		5	3	4	1	13	38%
Travel & Transportation	1	4	7	1		13	38%
Soil or Soil Biota	1	5	5	2	3	16	38%
Riparian	1	21	21	16	1	60	37%
Wilderness/WSA, Nat'l Trails or Riv	1	3	6	1		11	36%
Recreation	2	3	7	2		14	36%
Rangeland/Upland Habitat	2	27	28	22	7	86	34%
Forest/Woodland Habitat		10	15	4	2	31	32%
Animal Population	1	8	12	10	1	32	28%
Invasives		7	7	8	3	25	28%
Climate			4		1	5	0%
Other:	4	5	9	1		19	47%
Table Total	**17**	**131**	**149**	**85**	**20**	**383**	

q34a. How often are monitoring data shared with the public?

OFFICE	Never 1	2	3	4	Always 5	Total	Percent "Seldom or Never"
Lake Havasu FO	2	12				14	100%
Newcastle FO		3				3	100%
Buffalo FO		12	2			14	86%
Grand Junction FO		6	3			9	67%
Lewistown FO		6	3			9	67%
Glenwood Springs FO	2	9	6			17	65%
Ukiah FO	3	3	4			10	60%
Upper Snake FO	3	15	9	3		30	60%
Ely FO		3		3		6	50%
Kemmerer FO		5	5			10	50%
Klamath Falls RA		6	3	3		12	50%
Price FO		3	3			6	50%
Bishop FO		3		4		7	43%
Elko FO		2	3			5	40%
Tucson FO	1	3	6			10	40%
Safford FO		6	6	1	3	16	38%
Socorro FO		3	5			8	38%
Mile City FO	3	5	9	3	2	22	36%
Ashland RA		12	10	12		34	35%
Alturas FO		3	6			9	33%
Gunnison FO		3	3	3		9	33%
Anchorage FO		3	3	4		10	30%
Malheur RA	3	3		19		25	24%
Glendale RA		1	12			13	8%
Kingman FO		1	9		3	13	8%
			3			3	0%
Artic FO			3	5		8	0%
Bakersfield FO				3		3	0%
Battle Mountain FO			4	5		9	0%
Bruneau FO			5	3	4	12	0%
Little Snake FO			3			3	0%
Roswell FO			4	2	5	11	0%
Salmon FO			6	3		9	0%
Salt Lake FO			2			2	0%
South River RA			3	9	3	15	0%
Medford DO			6			6	0%
Total	**17**	**131**	**149**	**85**	**20**	**402**	

6. Does analysis of the data help us determine our effectiveness, and thereby help us focus our investments?

Court-related results:

q32. Within the last 3 years, has data quality, or lack of monitoring data been an issue in formal appeals of decisions, or lawsuits related to decisions?		
Scale	Count	Percent
Yes	89	49.4
No	91	50.6
Total	180	100

Big Finding…

q33. When challenged in court, how often are decisions upheld?		
Scale	Count	Percent
1 Never	0	0.0
2	7	14.3
3	20	40.8
4	13	26.5
5 Always	9	18.4
Total	49	100

New Data Gap: Do supervisors see the world differently than MEs?

	q32. Within the last 3 years, has data quality, or lack of monitoring data been an issue in formal appeals of decisions, or lawsuits?		
Mgr/Sup	Yes	No	Total
Yes	24	27	58
No	65	64	219
Total	89	91	277

	q32. Within the last 3 years, has data quality, or lack of monitoring data been an issue in formal appeals of decisions, or lawsuits?		
ME	Yes	No	Total
No	40	43	116
Yes	49	48	161
Total	89	91	277

These results show that both supervisors and MEs are evenly split on impact of data on appeals or lawsuits. No additional finding.

No, supervisors and MEs are evenly split on whether they see data quality or lack of monitoring data as an issue in appeals or lawsuits.

However, there are clear differences by FO. These differences may not be statistically significant, but may indicate areas for investigating best practices or areas that warrant additional investigation because the results cause concern as to cause of lack of monitoring data being an issue in lawsuits…

q32. Within the last 3 years, has data quality, or lack of monitoring data been an issue in formal appeals of decisions or lawsuits?				
OFFICE	**Yes**	**No**	**Total**	**Percent "Yes"**
Artic FO	1		1	100%
Barstow FO	1		1	100%
Elko FO	5		5	100%
Kingman FO	2		2	100%
Newcastle FO	1		1	100%
Salt Lake FO	4		4	100%
Medford DO	1		1	100%
Bruneau FO	7	1	8	88%
Malheur RA	7	1	8	88%
Ashland RA	10	2	12	83%
Mile City FO	7	2	9	78%
South River RA	2	1	3	67%
Bakersfield FO	3	2	5	60%
Roswell FO	3	2	5	60%
Upper Snake FO	6	5	11	55%
	1	1	2	50%
Anchorage FO	3	3	6	50%
Buffalo FO	4	4	8	50%
Glendale RA	2	2	4	50%
Klamath Falls RA	2	2	4	50%
Little Snake FO	2	2	4	50%
Price FO	2	2	4	50%
Battle Mountain FO	2	3	5	40%
Kemmerer FO	2	3	5	40%
Grand Junction FO	1	2	3	33%
Safford FO	1	2	3	33%
Ukiah FO	1	2	3	33%
Alturas FO	1	3	4	25%
Bishop FO	1	3	4	25%
Glenwood Springs FO	2	6	8	25%
Gunnison FO	1	4	5	20%
Tucson FO	1	5	6	17%
Ely FO		7	7	0%
Lake Havasu FO		4	4	0%
Lewistown FO		4	4	0%
Saguache FO		1	1	0%
Salmon FO		6	6	0%
Socorro FO		4	4	0%
Table Total	**89**	**91**	**180**	

6. Does analysis of the data help us determine our effectiveness, and thereby help us focus our investments?

q35. How often are monitoring data adequate (e.g. sufficient quantity & quality, appropriateness) to support land management decisions?

Scale	Count	Percent
inadequate to support decisions	11	4.2
2	47	17.9
3	73	27.8
4	68	25.9
adequate to support decisions	64	24.3
Total	263	100

q36. Are resources available to meet mandatory monitoring requirements (e.g. from Biological Opinions, Court Orders, etc?)

Scale	Count	Percent
1 Never	17	6.9
2	84	34.0
3	88	35.6
4	46	18.6
5 Always	12	4.9
Total	247	100

q37. How often do monitoring data help decide if land management actions taken by BLM are having the desired effect?

Scale	Count	Percent
1 Never	10	3.8
2	54	20.5
3	109	41.3
4	76	28.8
5 Always	15	5.7
Total	264	100

q38. How often does monitoring cause your Office to change land management actions? (E.g. management practices have been changed because a new T&E species population is located, or water quality has degraded, etc.)

Scale	Count	Percent
1 Never	9	3.4
2	73	27.8
3	96	36.5
4	67	25.5
5 Always	18	6.8
Total	263	100

q38a. How often is the monitoring design reviewed and revised when management actions change?

Scale	Count	Percent
1 Never	15	5.8
2	97	37.6
3	95	36.8
4	35	13.6
5 Always	16	6.2
Total	258	100

q39. How effectively does monitoring help your Office determine land management priorities? (E.g. if there is funding to treat only 50K acres of vegetation in poor condition, monitoring helps identify which acres to treat.)

Scale	Count	Percent
1 Very Ineffectively	19	7.2
2	77	29.3
3	74	28.1
4	76	28.9
5 Very Effectively	17	6.5
Total	263	100

Finding:
These are relatively normal distributions, suggesting there is significant room for improvement

Summary Finding

- AIM policies and practices seem to evolve without regard to a large-scale model of expected outcomes. At some level such a model could drive monitoring behavior across disciplines and field operations.
- The data imply that:
  - AIM information is being gathered independently by FOs,
  - Over-arching policies that drive the data collection have been developed by programs operating independently of each other.
- Much of the MA helps the immediate local multiple use customer to get the permit or use authorization needed &/or to comply with regulations, the bigger picture of the health of the land overall remains illusive. Some key monitoring employee survey indicators are:
  - Data appear to be program-specific and poorly integrated:
    - Only half of the data are effective in describing existing conditions, explaining changes in conditions, or in correlating trends in conditions with management actions.
    - However data are consistent enough and frequent enough to describe trends.
    - Further, 37% say monitoring is being done without reference to an ecological model.
  - Only about 27% of data are effective in serving across programs or at an aggregated level above FOs.
  - A significant amount of this data doesn’t appear to be summarized in a report or shared with the public (coordinated, 74% unfavorable; reported, 54% unfavorable; shared with public, 74% unfavorable).

Summary Findings, continued

- 50% of employees report that data quality or lack of data has been an issue in appeals or lawsuits over the last 3 yrs.
- A significant amount of this data does not appear to influence management decision-making.
  - Does data help us determine our effectiveness, and thereby help us focus our investments from five different aspects (e.g. supporting land management decisions, deciding if land management decision are having the desired effect, determining land management priorities), employee responses generate a normal distribution, suggesting there is significant room for improvement.
- 55-88% of MEs say there is NO monitoring plan.
  - Range and riparian are more likely to have a plan.
- MEs say guidance, supervision & training for monitoring is effective. So, the results above suggest that such guidance, training & supervision may be fragmented by program rather than being more holistic.
- PEs to control MA are all over the map.
  - While certain PEs are more often used than others within a program, 14 or more PEs are used by each of the top five MAs (range-23 PEs, riparian-20 PEs…).
  - For 12 MAs, including 3 of the top 5, employees report less than adequate PE to activity match (50% favorable). These results suggest that ABC may not be driving MA.

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I: Enterprise Architecture History of Monitoring Efforts

Prepared by: Northrop Grumman Information Technology
Contact: Chris Hawkinson

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Description

This document reviews various initiatives / projects (ALMRS, IDS, MIDAS, SVIM, Palm Pilot, SOSA architecture) related to monitoring that the Bureau of Land Management (BLM) has been involved with in the past; with information on what the projects were, and the history of the effort.

Findings

1) Automated Lands and Minerals Records System (ALMRS)

This was first module that was developed as part of a major effort called the Land Information System (LIS). LIS was the concept that everything at the BLM was tied to land. ALMRS was design to handle case processing and use authorizations. The automated monitoring module was to be developed at a later date once ALMRS and other parts of LIS were in place. The monitoring module was in initial design with the processes and high level data model completed.

- The initial phase of the multi-million dollar system was on the verge of implementation the late 1990s when the project was cancelled.
- The monitoring module did not have a design nor had it been prioritized with other components within LIS.

2) Inventory Data System (IDS)

IDS was a Bureau-wide database created in the late 1980s for storing, analyzing, and displaying monitoring/inventory data collected using the Soil Vegetation Inventory Method (SVIM) and Ecological Site Inventory (ESI). IDS itself consists of three databases: 1) site Write-up Area (SWA) species production and composition; 2) location (Section, Township, Range) of each SWA, ownership and administration; 3) soils and the location of the SWA on the landscape.

- information was not ‘validated’ before being importing to IDS, while other offices did not add the data to IDS.
- clean up of inventory data was time consuming; even though the data was “cleaned up” prior to import,
- some IDS system users had to further modify information such as misspelled vegetation names.
- not very flexible or user friendly and only a few people knew how to use it.
- when date fields were updated from 2 to 4 digit years for Y2K, it cuased the data in fields following the dates to be invalid.
- backup and correction of the database was either incomplete or has been destroyed.

At this time, the NM office is trying to import the IDS monitoring data into VMAP.

3) Monitoring Information Data Analysis System (MIDAS)

The purpose of MIDAS was to provide the BLM with an automated, modular database for the storage and statistical analysis of corporate data collected from all renewable resource monitoring efforts. It was created to maintain existing and historical data, facilitate additional data collection and analysis. (From IB 98-71). It was a DOS-based program released in 1988/89 for field use. There were two phases of MIDAS: complete analyses of Wilderness land designations and degradations and later to assist in tracking rangeland and grazing data. The first phase was to test whether global warming was impacting the environment by taking samples and measuring various environmental parameters such as vegetation, soil erosion, and air quality.

- state offices did not use the same protocols as Colorado State University,
- lack of specialists necessary to identify uncommon, smaller species.
- not able to monitor every ecological site,
- system was difficult to use and did not get good reviews.

Some Siefert, Arizona office data is now in VMAP. Because it is DOS-based, it can no longer be used. New Mexico has created scripts to pull the data from MIDAS into VMAP.

4) Soil Vegetation Inventory Method (SVIM)

SVIM was implemented in the late 1970s after the Carter Administration was sued for inadequate tracking of grazing and wilderness data; information was inconsistent and most State offices used different methods for collection. The purpose of SVIM was to determine livestock allocations and to calculate whether or not a species of plant would have grown more if there were less livestock on the land. A subset of SVIM (soil and vegetation methodology) became the Ecological Site Inventory (ESI). In Phase 1, soil was identified with an indexed range condition class compared to potential range site. In Phase 2, step point transects at random grid points, clipping and phrenology data were collected and used for allocating AMUs. There are approximately 45 SVIM/ESI data sets for offices throughout the BLM. This application was on a mainframe computer and had information on many millions of acres of BLM-administered land. SVIM was meant to create a consistent way to collect data and make it accessible and comprehendible for everyone. Originally data was collected by use of pen and paper. Some of this information was keypunched into the mainframe in Denver (precursor to the IDS). Later, some of the SVIM information was inputted into IDS.

- no online access; results were batch-processed and printed out on paper.
- access to some of the data was restricted and the calculation to determine grazing capacities was removed.
- did not work well because it either overestimated or underestimated data. Because BLM was using this information to make decisions for ranches, ranchers threatened to sue.
- issues with how the information was collected. In many cases, only small units of soil were studied, by using a hoop to mark a territory to study. Other field offices used larger boundary fences.
- guestemations were used when data could not be collected on species during their peak, varying study area sizes and differing peak season for plant species in the same geographic area.
- accuracy was also varied given that specialists also had to account for how much a certain species could have already been eaten by livestock.

In the early 1980s, SVIM was placed on a temporary hold because “data was being used incorrectly.” The data was then stored on 9-track tapes. In 1991, a CD was produced and distributed with the raw SVIM data.

5) Palm Pilot

No relevant information available for this study.

6) SOZA Architecture

The work completed in relation to Monitoring through SOZA was part of building the Enterprise Architecture. It focused on the processes of data collection from a business standpoint. They viewed the type of data being collected and clustered similar data together to aide in making business decisions on systems needed/required. This did not focus on pre-existing systems, but on the processes or activities that are done at the BLM.

- Because process models were created using programs such as ERWIN and CoolBiz, the information is hard to access; only a few people still have them on their computers; ost of the process models have been captured in an Adobe pdf format for ease of reading and hard copies can be found in the Records Room, Denver Federal Center.
- This did not result in a system. A logical data model was not part of this effort. However, the process models that were developed are being used as part of the Monitoring Business Process Re-engineering effort. LR2000 contains some of the functions that were to be part of ALMRS.

Summary

There were various reasons prior efforts did not succeed. In some cases, management did not commit to long-term support, including funding, of monitoring or the size of the effort was too large. Some systems were not supported when the administration changed. This could be because of change in focus or because the results of the monitoring were not agreed to by the various parties involved.
Sometimes the monitoring methods that were to be used within the system were not always appropriate for the area that was being monitored. Most of the systems were not user friend and did not have adequate reporting capabilities.

Document Abstract

Architecture Area:	BRM	Contract Number:	NBD020221
File Code(s)	BEA	Task number:	2
Subject Function Code(s):	1735, 1230		
The local monitoring group requested a history of monitoring and the various attempts at systems for monitoring..			

Revision History

Doc Status	Content as of Date	Author	Description of edit	Filename/lineage
WIP	11/15/2006	C Hawkinson		Mntr_arch_history_061204.doc

J: Business Process Re-Engineering Recommendations

DRAFT

National Monitoring Strategy

Business Process Re-engineering Recommendations

Prepared by: Northrop Grumman Information Technology
Contact: Chris Hawkinson

Original Content Date: March 20, 2007
Final Draft Date: May 3, 2007

National Monitoring Strategy Local Work Group Report

Introduction

The purpose of this Business Process Re-engineering (BPR) project was to understand and develop strategies for addressing the issues and problems associated with assessment, inventory, and monitoring (AIM) efforts within the Bureau of Land Management (BLM). The BLM has been funding AIM efforts for many decades, but has not been able to consistently summarize and provide results on a regional or national level. The National Monitoring Strategy decided to employ BPR as a means to analyze and make recommendations for AIM activities within the BLM.

The BPR effort was initially split into two sub-teams, one for vegetation/soil monitoring and the other for air/water monitoring. Team members were recruited from across the BLM, covering different programs, offices, and scientific/technical backgrounds. (See Appendix A for a list of the team members.) Each team had two workshops in which the proposed process model was developed and issues were discussed and documented.

The teams employed standard BPR methodologies as documented and implemented by the Bureau Enterprise Architecture (BEA) BPR Group. This approach includes up-front planning and documentation of expectations, developing an understanding of the current processes, identifying potential improvement areas, and documenting a proposed process model and recommendations for consideration.

To further understand the issues and refine the assessment, inventorying, and monitoring (AIM) process within the BLM, the project teams developed conceptual models of their data needs during a third workshop.

There are numerous definitions for monitoring, inventory, and assessment that can be found in various manuals, handbooks, and technical references across the BLM. Many of these terms are used interchangeably. For example, in one area the first time something is measured it is referred to as an inventory. If it is measured again, it is called monitoring. In other areas, all measurements are monitoring, even the first occurrence.

One result of the effort was the development of common definitions for assessment, inventory, monitoring, and evaluation as illustrated in Appendix C. The discussion found that inventory and monitoring is the collection of data and assessment and evaluation is the interpretation of data and other information. In this document, inventory and monitoring will be referred to as Data Collection and assessment and evaluation as Interpretation.

Common Findings

Findings covered a broad spectrum of categories including consistency and standards, reporting, planning, and program management. These findings are discussed in detail in the following paragraphs.

The teams discussed the fact that methods and indicators are not being used consistently across the BLM. A field office may use one or two methods for all of their data collection while another field office may use several methods. The method used can depend upon the education or training of the specific field person. More importantly, different habitat types may require different methods. For example, grassland requires different methods/methodology than timber areas. Variations in methods may also occur within a broad habitat type within different regions. For example, assessing small diameter timber in New Mexico would not necessarily employ the same methods as assessing large diameter timber in western Oregon. However, for certain regional or national data calls and broad scale questions such as “what is the condition of the forested land BLM manages,” there must be some level of commonality among field offices and regions.

There is a lack of consistent metadata[1] and data structures. Without a standard approach for data collection and reporting, field office dataset results are too varied and require manual effort to create any type of summarization, at the national or even regional level.

Many field offices also have difficulties with their Data Collection projects. Many smaller projects are implemented only when a field office has someone who has a little discretionary time to do the work. In other cases, monitoring is done with no specific purpose in mind (it is not tied to a Land Use Plan or a use authorization). Monitoring in some cases is being done for the “sake of monitoring” or because they have been collecting the same type of monitoring data for years and therefore continue to collect the same data. There are not subject matter experts (SMEs) available for every field office. This results in redundant or unnecessary Data collection projects as there is no coordination of similar efforts. It may also result in very programmatic data collection with little or no sharing across disciplines. Clear line of sight to organizational objectives is needed to ensure appropriate data are captured to maximize reuse of information and develop comprehensive, meaningful reports to management.

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[1] Metadata describes the content, quality, condition, and other characteristics of data. Metadata is vital in helping potential users to find needed data and determine whether a data set will meet their needs before they spend the time and money to obtain and process it.

Although they are in the process of developing a BLM handbook, the Air and Water team has not had a standard practice for conducting data collection. This results in many smaller projects that are not cohesive.

Both BPR teams felt that budget constraints challenge efforts to make the process uniform, consistent, and basic.

Much of the Data Collection effort is dependant on good, solid, and quantifiable goals and objectives developed as part of Planning (Land Use, Authorizations, and Resource Management). Unfortunately, these plans are not always written with clearly stated, measurable objectives. Detailed goals and objectives in activity plans would also help. The BPR teams feel that the BLM’s interpretation of inventory or monitoring data is often either not used or not used effectively to alter/improve the management actions (adaptive management). The BPR teams would like to request a standard mechanism to provide feedback to the planning community and management to ensure that data interpretation is used effectively to inform and shape planning and implementation decisions.

Air and water monitoring uses the Environmental Protection Agency’s (EPA) Quality Assurance Plan (QAP) as a checklist, but these checklists are not always followed for every project. Vegetation monitoring may need a standardized quality assurance checklist similar to the air/water monitoring QAP.

Lastly, BLM’s AIM-related activities do not have an overall management program or scheme for data collection, storage, and utility. This can lead to poor quality data, loss of data, or lack of access to data that could be of value to other programs or projects. There is no plan for what should happen to the data once an effort is complete (data storage, handoff, and sharing).

Initial Recommendations

Based on the results of the two sets of workshops, several potential recommendations were identified and reviewed by the team. Both sub-teams expressed concern that these recommendations not be implemented all at once, but over time so current workloads are not critically impacted. Once the following recommendations have been agreed upon and prioritized, there will need to be implementation plans defined, which will need to address training and Change Management issues.

Develop and Implement Data Management and Records Management Strategies

Because inventory and monitoring activities do not have an overall data management strategy, there is an inconsistency in what metadata is collected and how it is managed over time. Data sets are collected and stored in file cabinets often without adequate title page information. This information would ensure that individual data sets are tied to specific locations on the ground and the work could be repeated consistently in the same location.

The BLM is currently developing an overall data management strategy plan. This strategy and the monitoring data management strategies at the EPA, the US Geological Survey (USGS), and National Park Service (NPS) should be reviewed to see if some or most of their ideas can be included in a data management strategy for AIM. The range program utilizes the Handbook 4010-1, Range Management Records for consistent data collection and storage; however, the BLM does not have an overarching data management strategy. This strategy could include:

a. Corporate vs. Local Data. Not all raw data collected can be considered corporate (having utility at a regional or national level), though the results and summarization of data could be. There must be criteria for determining/standardizing what AIM data is corporate and what is for local use only.

b. Archive Plan. A Data Archive Plan and related policy should be developed and implemented to help guide data distribution to a data warehouse (a centralized data storage location accessible to many people). Not all raw data needs to be made available outside of the BLM and the data archive plan will help determine which data belongs in the warehouse. Some data may be of value to other monitoring/inventory projects, other program areas, or even to sister agencies/cooperators.

c. Quality Assurance. Water and Air Monitoring projects use the EPA's Quality Assurance Plan (QAP) checklist as a template. The Vegetation team has reviewed the QAP checklist and found that it would be of value to use a modified version of it for vegetation-related projects to ensure standardization and control quality.

This recommendation has dependencies with the Data Collection and Archiving recommendations. The BLM will need to have an archive plan in place before it can determine the structure and content of the data warehouse since the proposed warehouse will hold the archived data.

Incorporate the Process Models into BLM Handbooks and Technical References

Numerous manuals, handbooks, and technical references for monitoring and inventory of vegetation projects currently exist. The air/water monitoring disciplines are developing handbooks. The teams recommend that the steps for completing a monitoring and inventory project be based on the process models developed during the BPR and incorporated into each program's guidance. The guidance would also include:

a. Project Checklist. A list and description of each step for the project including which steps are required and which ones are optional for AIM-related activities. This would be based on the size and complexity of the effort. Products for each step would be included, as well as templates for the products.

b. Standardized Objective. A standardized collection objective format to ensure that objectives are measurable.

c. Definitions. For consistency, all handbooks and references pertaining to assessments, inventory, monitoring, and evaluation would use standard definitions agreed to during the BPR efforts.

Data Collection and Archiving

Consistent collection and accessibility of monitoring and inventory data across the BLM is needed. Much of the data that is collected remains in file drawers, on shelves, or in locally constructed spreadsheets and are neither available nor interpreted for immediate use, future projects, or even to other programs within the same office. Most of it is in paper format and not as usable as it could be. At the field level, detailed data is required to complete their (*whose analysis and for what?)* analysis. Managers are interested in outcomes derived from the interpretation of monitoring data. To provide a means for all users to have appropriate access to data, the following recommendations are suggested:

a. Shared Data Structure / Services. Develop, purchase or modify existing data structures[2] for capturing raw monitoring and inventory collection data (Shared Data Structure). These shared data structure components could then be used for the standardized tools (see c. later in this recommendation) and incorporated into existing systems that conduct monitoring. All individuals collecting inventory or monitoring data would enter this data into a common data structure. This will ensure that data is standardized and captured consistently across projects.
Vegetation would have its own shared data structure based upon their data requirements, whereas air, water and climate could either be separate data structures or a shared data structure depending on the completion of the AIM data model and research into existing

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[2] A shared data structure is where the physical database has the same set of tables and columns. AIM projects would share the same database or have individual databases using the same data structure.

internal or external systems. Other potential shared data structures could be for the Proper Functioning Condition or Land Health Assessment activities.
The BPR revealed that there are differences between the types of data collected. Vegetation sampling methods employ strict protocol outlined in handbooks and technical reports. However, treatment effectiveness of vegetation such as prescribed burning, thinning, or weed eradication employs best management practices which have a degree of art aligned with the science. This is due in large part to the fact that the laboratory is the rangeland or the woodland and repeatability of the methods are affected by environmental factors such as precipitation. In contrast, soil, water, and air programs are more aligned with regulatory standards and methods that can be repeated exactly under laboratory conditions. Many of the BLM's monitoring projects look at climate data to assist in making determinations.
Data in the shared data structures would be for current inventory and monitoring data; however, this would not be all inclusive of the data required to make informed management decisions. The shared data structure would provide users the ability to apply analytical tools to the data and to incorporate data from other sources (e.g. precipitation, soil survey, geospatial) as needed for each monitoring effort. The data may be moved out of the shared database when the project was completed, based on its archive plan criteria (see the first recommendation of Data Management Strategies above).
Both teams feel that local and State offices should have access to / and control of their own data, rather than having one national database for each discipline. There would be geospatial data capabilities with data standards for each of the data layers that could be shared nationally.

b. Preferred Methods and Protocols. There are preferred methods and protocols for each of the disciplines. These methods would be incorporated into the shared database structure with a link or reference to the Technical Reference or other documentation that contains the protocol. The NPS has a website which includes vegetation protocols that could be utilized by the BLM. There may be an opportunity for a department-wide best practice steering group.

c. Standardized Tools. As part of the shared data structures, there needs to be a standardized set of tools such as PDAs or "ruggedized" notebooks that would interface with the shared data structure databases. These collection tools would use the shared data services / data structures as discussed in (a.) of this recommendation. They would also be geospatially enabled for drawing plot layout and sample locations. By embedding business rules into the data capture process, high quality data can could be obtained in a more consistent and efficient manner.

d. Data Warehouse. Develop a data warehouse where datasets of monitoring/inventory projects and some of the data interpretation is moved out of the database and transferred to a data warehouse. This data warehouse could be a modified version of an existing database or Commercial off-the Shelf (COTS) purchase. The BLM has a huge amount of historical (legacy) data, either in paper form or in home grown databases, which could be imported or entered into the data warehouse. The data management archive plan would outline what data is moved to the warehouse and how it would be certified and validated before it is placed in the warehouse. The warehouse would include geospatial data layers and hold data that are used for regional or national reporting.

e. External Data. A considerable amount of data describing public rangelands are collected and stored by other agencies and entities such as National Resource Conservation Service (NRCS), USGS, Agriculture Research Service (ARS), etc. Some of these data have been indirectly paid for by the BLM. It may be beneficial and cost-effective for the BLM to acquire and use this data.

f. Knowledge Repository. Develop a knowledge repository for the final reports generated from a monitoring or inventory effort. Currently, many of these reports are not made available to others who could learn from them or use the data/interpretations in other decision making or reports. Some of these reports may contain pertinent results that do not need to be recreated in a new project. The knowledge repository would contain final monitoring reports, and possibly external data source and journal article citations documented in or used by prior studies. It would be necessary to have a set of subject matter experts who would be responsible for the certification and validation of what is placed in the repository and to develop the keywords associated with each item in the repository. The knowledge repository could be used by partner agencies, universities, or cooperators to access information relevant to their needs.

g. Centralized Web Site. The BLM would benefit from a centralized information portal/hub on the intranet. This hub could include access to the shared data structures, the knowledge repository, training, and links to the BLM library for technical references, as well as project tools, checklists, templates, and products. The NPS has a website devoted to their monitoring efforts and the BLM could use that as a template.

Training and Mentoring Program

During the BPR effort, it was pointed out that there are as many monitoring methods/methodologies in use as there are employees collecting data. Some of these methods/methodologies are historic, and others are more recent. With so many differing methods available, new employees or employees changing offices may not have the experience necessary to walk in and begin monitoring with little or no training or mentoring. It has been the experience of the National Riparian Service Team that on-the-ground, hands-on training is required for Data Collection protocols to be applied uniformly and for data interpretation to be consistent and correct. Recommendations from the BPR teams include:

a. Provide basic planning and project management training to people who will be conducting monitoring and inventory projects which would be based on the process models developed for vegetation and air/water monitoring. This would include templates and guidance for developing/designing monitoring plans.

b. Develop training courses (classroom and web-based) for each of the disciplines on collection, data management, and analysis methods.

c. Designate a monitoring lead / subject matter expert in each district office that could provide mentoring to new hires or people starting their first monitoring/inventory efforts. The monitoring lead would also ensure that monitoring efforts in that district are coordinated to reduce duplicate or overlapping efforts. To be fully effective, the monitoring leads should meet on an annual or semi-annual basis to review the methods and procedures used for all monitoring and inventory efforts within the BLM. This would include data management not covered by the technical references.

d. Include as a role of the National Operations Center (NOC) the development and updating of tools and methods for inventory, assessment, and monitoring as well as coordination and technical support to the district monitoring/subject matter experts.

Recommendations outside Control of this Initiative

During the BPR workshops, the feedback loop between Planning and the monitoring and inventory work was discussed many times. The teams felt the guidance for Land Use Planning (LUP) does not adequately describe the process to generate quality LUPs goals/objectives or inventory and monitoring plans to answer the question of effectiveness of LUPs. To conduct a monitoring or inventory activity, offices need clear resource objectives that are measurable and have a timeframe. The BPR teams proposed that the next iteration of the LUP handbook have a section that illustrates the linkages between how and why monitoring is conducted and how it feeds into the mid- and long-term goals of LUPs. When the knowledge repository is in place, planners would be able to access the Final Reports on inventory and monitoring efforts from their local office in addition to Bureauwide reports of interest.

Appendix A: Project Teams

Air/Water Monitoring Team

Angela Zahniser, co-lead	Michael Eberle, co-lead	Steve Tryon*
Scott Archer	Herb Arnold	Susan Caplan
Steve Swanson	Jim Fogg	Karl Ford
Heidi Hadley	Chester Novak	Ed Rumbold
Paul Schlobohm	Jeff Simms	Mark Vinson
Ron Wiley*	* Also serves on the Vegetation Monitoring BPR Team	

Vegetation Monitoring

Jack Hamby, Co-Lead	John Spain, Co-Lead	Steve Tryon
Bryce Barlan	Tim Bottomley	Rob Burton
Jony Cockman	Phil Cooley / Sherm Karl	Danielle Flynn
Ed Horn	Myron Hotinger	Kathie Jewell
Cal McCluskey	Ron Wiley	John Willoughby

Appendix B: Proposed Process Models

Air/Water Monitoring and Inventory

- A1. Identify Management Questions
  - A1.1 Understand the Issue
  - A1.2 Determine Scale
  - A1.3 Identify Indicators
  - A1.4 Conduct Cursory Literature Review
  - A1.5 Determine Type of Monitoring
  - A1.6 Prioritize Question
- A2. Develop Monitoring Objective
  - A2.1 Define Monitoring Objective
  - A2.2 Determine if Monitoring Objective Will Address Management Question
  - A2.3 Consult with Stakeholders on Objectives
- A3. Analyze Background Information
  - A3.1 Conduct Literature Review
  - A3.2 Evaluate Information
  - A3.3 Consult with Management
- A4. Develop AIM Plan
  - A4.1 Research and Select Methodology
    - A4.1.1 Determine Metrics
    - A4.1.2 Determine Area of Responsibility
    - A4.1.3 Select and Identify Sample Location
    - A4.1.4 Determine Sample Size
    - A4.1.5 Determine Frequency of Data Collection
    - A4.1.6 Determine Protocols
    - A4.1.7 Document Analysis Procedures
    - A4.1.8 Determine Format for Displaying Results
  - A4.2 Select Mechanisms (Logistics, Equipment, Contract and Budget)
  - A4.3 Develop Data Management Plan
  - A4.4 Develop Quality Assurance Project Plan
  - A4.5 Finalize AIM Plan
    - A4.5.1 Determine Feasibility
    - A4.5.2 Conduct Peer/Management Review
    - A4.5.3 Collect Stakeholder Feedback
- A5. Collect Data
  - A5.1 Mobilize Personnel and Equipment
  - A5.2 Collect and Process Data or Samples
  - A5.3 Conduct QC Checks
  - A5.4 Maintain Data Acquisition System
- A6. Analyze and Evaluate Data
  - A6.1 Validate Quality and Sufficiency of Data
  - A6.2 Analyze and Interpret Results
  - A6.3 Make Recommendations

A6.4 Conduct Peer Reviews
A6.5 Complete Final Report
A6.6 Brief Management

Vegetation Monitoring and Inventory

- A1 Conduct Pre-work
    - A1.1 Define Purpose of Work (data for planning - FLPMA)
    - A1.2 Review Action Goals (scoping at a high level)
    - A1.3 Determine Type of Data Needs
    - A1.4 Review Existing Information
    - A1.5 Pre-assess Work Needs
- A2 Develop/Refine Objectives
    - A2.1 Determine Management Objective
        - A2.1.1 Determine Management Timeframe
        - A2.1.2 Specify Desired Outcome
    - A2.2 Select Attributes/Indicators
    - A2.3 Determine Sampling Guidelines (by attribute and level of precision)
- A3 Develop AIM Plan
    - A3.1 Develop Sample Design
        - A3.1.1 Determine Metrics
        - A3.1.2 Determine Area of Responsibility (BLM vs. contract)
        - A3.1.3 Select and Identify Sample Location (method dependent)
        - A3.1.4 Determine Sample Size
        - A3.1.5 Determine Frequency of Data Collection
        - A3.1.6 Determine Protocols
        - A3.1.7 Document Analysis Procedures
        - A3.1.8 Develop Schedule
    - A3.2 Determine Quality Control Requirements
        - A3.2.1 Develop QAP
        - A3.2.2 Determine Sample Chain of Custody (external or internal)
        - A3.2.3 Determine Skill Requirements
    - A3.3 Determine Logistics
    - A3.4 Finalize AIM Plan
        - A3.4.1 Determine Feasibility
        - A3.4.2 Conduct Peer/Management Review (may require signature)
- A4 Implement AIM Study
    - A4.1 Train Data Collectors
    - A4.2 Collect and Process Data
        - A4.2.1 Collect Raw Data
        - A4.2.2 Enter Raw Data
        - A4.2.3 Conduct QA/QC of Data
    - A4.3 Conduct Analysis of Data
        - A4.3.1 Review Outside Factors
        - A4.3.2 Incorporate Other AIM Project Data (compare results of other projects)
- A5 Develop Findings and Recommendations
    - A5.1 Assess Results/Make Judgments
    - A5.2 Evaluate Results/Determine Causal Factors

- A5.3 Review Findings
  - A5.3.1 Provide Feedback and Findings to Management
  - A5.3.2 Conduct Review
- A5.4 Complete Final Report

External Process: Adjust Management

Appendix C: Definitions

	DATA GATHERING AND INITIAL ANALYSIS	
	INVENTORY	**MONITORING**
Purpose	Inventories are the systematic acquisition of resource information needed for planning and management purposes. An inventory can be an initial collection of baseline data, but it may be repeated over time to establish a new baseline.	Monitoring is the periodic collection of information periodically to be used to evaluate progress in meeting management objectives and/or evaluate resource conditions.
Temporal Nature, Types of Data	Inventories are conducted at a point in time utilizing qualitative or quantitative measurements.	Monitoring captures qualitative and/or quantitative information, with reproducible results, over a period to detect resource change.
Relationship to other A,I, or M	Inventories cam be used to establish baselines for monitoring. The results of inventories can also be used in an assessment.	Inventory can provide baseline information for monitoring. Monitoring data may be used in assessments and/or evaluations.

	DATA INTERPRETATION	
	ASSESSMENT	**EVALUATION**
Purpose	Assessments provide judgment or apply criteria on the condition of resources the agency manages and inform an evaluation, which can be used to make or support a management decision. Assessment do not account for causality. Rather, they are judgments on the condition of a resource. Assessments are conducted at a point in time using qualitative or quantitative measurements from new or available information including inventory and monitoring.	Evaluations determine if legal standards or program management objectives are being met, and help determine the cause of a condition. This results in recommendations being made to adjust management actions (implementing adaptive management).

K: Selected Statutes Obligating the DOI to Inventory, Assess, or Monitor Natural Resources

Taylor Grazing Act of 1934: 43 U.S.C. § 315 *et seq.*

This Act was the first federal effort to regulate grazing on federal public lands. It establishes grazing districts and uses a permitting system to manage livestock grazing in the districts. 43 U.S.C. § 315. The Act provides for the classification of lands for particular uses. 43 U.S.C. § 315f. Additionally, the Act authorizes the Secretary to continue the study of erosion and flood control and to perform such work as may be necessary amply to protect and rehabilitate the areas subject to the provisions of the Act. 43 U.S.C. § 315a.

Fish and Wildlife Coordination Act of 1934, as amended: 16 U.S.C. § 661 *et seq.*

This act authorizes surveys and investigations of the wildlife on public domain lands including lands and waters of interest therein acquired or controlled by any agency of the United States.

16 U.S.C. § 661 states that the “Secretary of the Interior is authorized (1) to provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations in the development, protection, rearing, and stocking of all species of wildlife, resources thereof, and their habitat, in controlling losses of the same from disease or other causes, in minimizing damages from overabundant species, in providing public shooting and fishing areas, including easements across public lands for access thereto, and in carrying out other measures necessary to effectuate the purposes of said sections; (2) to make surveys and investigations of the wildlife of the public domain, including lands and waters or interests therein acquired or controlled by any agency of the United States; and (3) to accept donations of land and contributions of funds in furtherance of the purposes of said sections.”

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Wilderness Act of 1964, as amended: 16 U.S.C. § 1131 *et seq.*

The Wilderness Act established the National Wilderness Preservation System. The Secretary of the Interior was directed to review every roadless area of 5,000 acres or more and every roadless island within the national wildlife refuge and national park systems for possible inclusion in the System. “Within ten years after September 3, 1964 the Secretary of the Interior shall review every roadless area of five thousand contiguous acres or more in the national parks, monuments and other units of the national park system and every such area of, and every roadless island within, the national wildlife refuges and game ranges, under his jurisdiction on September 3, 1964 and shall report to the President his recommendation as to the suitability or nonsuitability of each such area or island for preservation as wilderness.” 16 U.S.C. § 1132(c).

16 U.S.C. § 1131(a) permits the gathering of resource information in wilderness areas. Wilderness areas “shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of

these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness." *Id.*

Additionally, each agency administering any area designated as wilderness "shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve its wilderness character. Except as otherwise provided in this chapter, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use.". 16 U.S.C. § 1133(c).

National Historic Preservation Act of 1966, as amended: 16 U.S.C. § 470, et seq.

Procedures to be followed by Federal Land managers in providing protection for archaeological resources located on public lands. The Secretary shall, at least once every 4 years, in consultation with the Council and with State Historic Preservation Officers, review significant threats to properties included in, or eligible for inclusion on, the National Register, in order to: (A) determine the kinds of properties that may be threatened; (B) ascertain the causes of the threats; and (C) develop and submit to the President and Congress recommendations for appropriate action. 16 U.S.C. § 470a(a)(8).

Section 106 directs Federal agencies to take into account effects of their actions ("undertakings") on properties in or eligible for the National Register. "The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under part B of this subchapter a reasonable opportunity to comment with regard to such undertaking." 16 U.S.C.A. § 470f

Section 110(a) sets inventory, nomination, protection, and preservation responsibilities for Federally-owned cultural properties. "The heads of all Federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by such agency." 16 U.S.C. § 470h-2(a)(1). Additionally, this section requires that each Federal agency establish a preservation program for "the identification, evaluation, and nomination to the National Register of Historic Places, and protection of historic properties" that will ensure that, inter alia, "historic properties under the jurisdiction or control of the agency, are identified, evaluated, and nominated to the National Register" and "that such properties under the jurisdiction or control of the agency as are listed in or may be eligible for the National Register are managed and maintained in a way that considers the preservation of their historic, archaeological, architectural, and cultural values in compliance with section 470f of this title and gives special consideration to the preservation of such values in the case of properties designated as having National significance." 16 U.S.C. § 470h-2(a)(2).

Section 110(c) requires each Federal agency to designate a Preservation Officer to coordinate activities under the act. 16 U.S.C. § 470h-2(c).

Section 110(f) requires that "prior to the approval of any Federal undertaking which may directly and adversely affect any National Historic Landmark, the head of the responsible Federal agency shall, to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmark, and shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking." 16 U.S.C. § 470h-2(f).

Section 106 of the act is implemented by regulations of the Advisory Council on Historic Preservation, 36 C.F.R. Part 800. The Department of the Interior criteria and procedures for evaluating a property's eligibility for inclusion in the National Register are at 36 C.F.R. Part 60.

Wild and Scenic Rivers Act of 1968, as amended: 16 U.S.C. § 1271 *et seq.*

This Act sets for the policy that "certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations." 16 U.S.C. § 1271. This Act requires Federal land management agencies to identify potential river systems and then study them for potential designation as wild, scenic, or recreational rivers. The Secretary "shall study and submit to the President reports on the suitability or nonsuitability for addition to the national wild and scenic rivers system of rivers which are designated herein or hereafter by the Congress as potential additions to such system" and "shall give priority to those rivers (i) with respect to which there is the greatest likelihood of developments which, if undertaken, would render the rivers unsuitable for inclusion in the national wild and scenic rivers system, and (ii) which possess the greatest proportion of private lands within their areas." 16 U.S.C. § 1275(a).

National Trails System Act of 1968, as amended: 16 U.S.C. § 1241 *et seq.*

The purpose of this act is to establish a national system of trails "for the ever-increasing outdoor recreation needs of an expanding population and in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation. 16 USCA § 1241(a). The system consists of national recreation trails, national scenic trails, national historic trails and connecting or side trails. The Secretary of the Interior must submit biennially to Congress a National Trails System plan. This plan must indicate the scope and extent of the completed nationwide system of trails. 16 U.S.C. § 1242(a). The Secretary of the Interior or the Secretary of Agriculture, as appropriate, must undertake additional studies to determine the feasibility of designating other trails as national recreation trails, national scenic trails, or national historic trails. 16 U.S.C. § 1243(a); 16 U.S.C. § 1244(a); 16 U.S.C. § 1245(a). Additionally, the Secretary is required to provide for the development and maintenance of such trails within federally administered areas and shall cooperate with and encourage the States to operate, develop, and maintain portions of such trails which are located outside the boundaries of federally administered areas. 16 U.S.C. § 1246(h)(1).

National Environmental Policy Act of 1969, as amended: 42 U.S.C. § 4321 *et seq.*

Under NEPA. Congress requires that all federal agencies include a detailed environmental impact statement (EIS) in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment. 42 U.S.C. § 4332(C). An EIS must include an examination of the environmental impacts of the proposed action, any unavoidable adverse environmental effects and alternatives available to the proposed action. 42 U.S.C. § 4332(C)(i), (ii), (iii). Agencies must examine and include the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. 42 U.S.C. § 4332(C)(iv), (v). Prior to preparing an EIS, the agency must consult with other federal agencies having expertise on any environmental impact involved. 42 U.S.C. § 4332(C). BLM compliance with this act necessitates monitoring in order to demonstrate environmental effects. Executive Order Number 11991 declares that, consonant with Title I of the National Environmental Policy Act of 1969, the heads of Federal agencies shall "(a) Monitor, evaluate, and control on a continuing basis their agencies' activities so as to protect and enhance the quality of the environment. Such activities shall include those directed to controlling pollution and enhancing the environment and those designed to accomplish other program objectives which may affect the quality of the environment." Exec. Order No. 11,991, 42 FR 26967 (May 24, 1977).

Clean Air Act of 1970, as amended 42 U.S.C. § 7401 *et seq.*

The Federal Air Pollution Control Act, commonly known as the Clean Air Act (CAA), creates a partnership between federal and state regulatory bodies to address air pollution issues on both a national and local level.

Part C of the Act, 42 U.S.C. §§ 7470-7492, specifies requirements of the prevention of significant deterioration program (PSD), which protects areas of the United States that have air quality that exceeds the National Ambient Air Quality Standards. Additionally, visibility standards are required for national parks and other areas where visibility is found to be of special value. This Part of the CAA sets out standards that must be taken into account before new pollution sources can be approved.

The CAA further requires permits for all major industrial sources subject to state administration and federal oversight in 42 U.S.C. §§ 7661-7661f and establishes a program for controlling substances that contribute to depletion of stratospheric ozone, 42 U.S.C. §§ 7671-7671g.

Wild Free-Roaming Horses and Burros Act of 1971, as amended: 16 U.S.C. § 1331 *et seq.*

The Act directs the Secretaries to protect and manage wild free-roaming horses and burros as components of the public lands. 16 U.S.C. § 1331. Wild free-roaming horses and burros are to be managed “in a manner that is designed to achieve and maintain a thriving natural ecological balance on the public lands.” 16 U.S.C. § 1333(a). Additionally, the Secretary is required to “maintain a current inventory of wild free-roaming horses and burros on given areas of the public lands. The purpose of such inventory shall be to: make determinations as to whether and where an overpopulation exists and whether action should be taken to remove excess animals; determine appropriate management levels of wild free-roaming horses and burros on these areas of the public lands; and determine whether appropriate management levels should be achieved by the removal or destruction of excess animals, or other options…” 16 U.S.C. § 1333(b)(1).

Clean Water Act of 1972, as amended, 33 U.S.C. § 1251 *et seq.*

The Federal Water Pollution Control Act, popularly known as the Clean Water Act, is a comprehensive statute aimed at restoring and maintaining the chemical, physical and biological integrity of the nation's waters at a quality which provides protection for fish, shellfish, wildlife, and recreational use. It also requires States to assess their rivers, streams, and lakes and to develop non-point source management programs to control and reduce specific non-point sources of pollution.

Section 301 (33 U.S.C. § 1311) prohibits the discharge of any pollutant except those made in compliance with the terms of the act. It imposes multi-tiered effluent limitations on existing sources the stringency and timing of which depends on the nature of the pollutant discharged and the body of water into which it is discharged.

Section 302 (33 U.S.C. § 1312) authorizes the imposition of more stringent effluent limitations when necessary to improve or maintain water quality.

Section 304 (33 U.S.C. § 1314) requires EPA to adopt water quality criteria and guidelines for effluent limitations and supervision of the NPDES program.

Section 319 (33 U.S.C. § 1329) requires states and tribes to identify waters that cannot meet water quality standards due to nonpoint sources and the activities that are creating the problem. The section then instructs states to prepare management plans for the waters that will identify controls and programs for the effluent sources.

Section 402 (33 U.S.C. § 1412) requires a permit for the disposal of dredge or fill material into navigable waters.

Endangered Species Act of 1973, as amended: 16 U.S.C. § 1531 *et seq.*

Section 7(a)(1) (16 U.S.C. § 1536) requires federal agencies to carry our programs to conserve threatened and endangered species

Section 7(a)(2) (16 U.S.C. § 1536) directs all federal agencies to insure that any action authorized, funded or carried out by the agency (agency action) is not likely to jeopardize the continued existence of an endangered or threatened species, or result in destruction or adverse modification of a critical habitat of a species. Agencies are required to use the best scientific and commercial data available to fulfill this charge. If, based on the best scientific and commercial data available, the Secretary determines that such species are present; the agency must conduct a biological assessment to identify the species likely to be affected.

Section 7(c) (16 U.S.C. § 1536) directs each Federal Agencies to conduct biological assessments for the purpose of identifying any endangered or threatened species.

Federal Land Policy Management Act of 1976, as amended: 43 U.S.C. § 1701 *et seq.*

This Act requires that public lands and their resources be periodically and systematically inventoried and that an evaluation of the current natural resource use and values is made of public and adjacent non-public land.

43 U.S.C. § 1732(a) directs the Secretary of the Interior to "take any action necessary to prevent unnecessary or undue degradation of the lands."

43 U.S.C. § 1701(a)(8) declares that it is the policy of the United States that "the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use;"

43 U.S.C. § 1711(a) requires the Secretary of the Interior "prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values (including, but not limited to, outdoor recreation and scenic values), giving priority to areas of critical environmental concern. This inventory shall be kept current so as to reflect changes in conditions and to identify new and emerging resource and other values. The preparation and maintenance of such inventory or the identification of such areas shall not, of itself, change or prevent change of the management or use of public lands."
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Soil and Water Conservation Act of 1977, as amended: 16 U.S.C. § 2001 *et seq.*

Section 5 authorizes the Federal Government to obtain and maintain information of the current status of soil, water, and related resources. 16 U.S.C. § 2004. The act further requires an integrated system capable of using combinations of resource data to determine the quality and capabilities for alternative uses of the resource base and to identify areas of local, State, and National concerns. 16 U.S.C. § 2005.

Forest and Rangeland Renewable Resources Research Act of 1978, and as amended by Forest Ecosystems and Atmospheric Pollution Research Act of 1988 and the Food Agriculture, Conservation, and Trade Act of 1990: 16 U.S.C. § 1641 *et seq.*

This Act provides the Secretary authority to conduct, support, and cooperate in investigations, tests, and other activities necessary to obtain, analyze, develop, demonstrate, and disseminate scientific information about protecting, managing, and utilizing forest and rangeland renewable resources in rural, suburban, and urban areas. 16 U.S.C. § 1641(a)(7). It authorizes the development and implementation of improved methods of survey and analysis of forest inventory information. 16 U.S.C. § 1644. In addition, it authorizes a determination of the cause of changes in the health and productivity of domestic forest ecosystems and to monitor and evaluate the effects of atmospheric pollutants on such ecosystems. 16 U.S.C. § 1642.

Public Rangelands Improvement Act of 1978: 43 U.S.C. § 1901 *et seq.*

This Act establishes a national policy and commitment to improve the conditions on public rangelands, requires a national inventory and consistent federal management policies, and provides funds for range improvement projects. 43 U.S.C. § 1901(b). It also amends the Wild Free-Roaming Horses and Burros Act and the Federal Land Policy and Management Act of 1976, both of which are summarized in this section. 43 U.S.C. § 1901(a)(6); 43 U.S.C. § 1903(a). BLM compliance with this act necessitates monitoring in order to share information and demonstrate rangeland improvements. The Act states that "the Secretary of the Interior and the Secretary of Agriculture shall update, develop (where necessary), and maintain on a continuing basis an inventory of range conditions and record of trends of range conditions on the public rangelands, and shall categorize or identify such lands on the basis of the range conditions and trends thereof as they deem appropriate. Such inventories shall be conducted and maintained by the Secretary as part of the inventory process required by Section 201 (a) of the Federal Land Policy and Management Act, and by the Secretary of Agriculture in accordance with section 1603 of title 16; shall be kept current on a regular basis so as to reflect changes in range conditions; and shall be available to the public." 43 U.S.C. § 1903(a).

Data Quality Act of 2001 and "Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies" 2002 Public Law 106-554, 114 STAT. 2763 (2002).

Agencies are directed to develop information resources management procedures for reviewing and substantiating the quality (including the objectivity, utility, and integrity) of information before it is disseminated. These guidelines stress the importance of having agencies apply these standards and develop their administrative mechanisms so they can be implemented in a common sense and workable manner. Four substantive terms regarding information disseminated by Federal agencies are included in the Act: quality, utility, objectivity, and integrity.

Healthy Forests Restoration Act of 2003: 16 U.S.C. § 6501 *et seq.*

One purpose of this Act is to promote systematic gathering of information to address the impact of insect and disease infestations and other damaging agents on forest and rangeland health. 16 U.S.C. § 6501. Additionally, for each Forest Service administrative region and each Bureau of Land Management State Office, the Secretary shall monitor the results of a representative sample of the projects authorized under this title for each management unit; and not later than 5 years after the date of enactment of this Act, and each 5 years thereafter, issue a report that includes an evaluation of the progress towards project goals; and recommendations for modifications to the projects and management treatments. 16 U.S.C. § 6512(g)(1). The results of a monitoring report shall be made available for use (if appropriate) in an authorized hazardous fuels reduction project conducted in a similar vegetation type on land under the jurisdiction of the Secretary. 16 U.S.C. § 6512(g)(3). Monitoring and assessment shall include a description of the changes in condition class, using the Fire Regime Condition Class Guidebook or successor guidance. 16 U.S.C. § 6512(g)(4). In an area where significant interest is expressed in multiparty monitoring, the Secretary shall establish a multiparty monitoring, evaluation, and accountability process in order to assess the positive or negative ecological and social effects of authorized hazardous fuel reduction projects. 16 U.S.C. § 6512(g)(5). Additionally, "for each administrative unit, the Secretary shall track acres burned, by the degree of severity, by large wildfires (as defined by the Secretary)." 16 U.S.C. § 6512(g)(6). The Act also requires the Secretary to develop, the maximum extent practicable, "a process for monitoring the need for maintenance of treated areas, over time, in order to preserve the forest health benefits achieved." 16 U.S.C. § 6512(g)(8).

Energy Policy Act of 2005 Public Law 109-58,119 Stat 594 (2005).

Section 364: “Each State energy conservation plan with respect to which assistance is made available under this part on or after the date of enactment of the Energy Policy Act of 2005 shall contain a goal, consisting of an improvement of 25 percent or more in the efficiency of use of energy in the State concerned in calendar year 2012 as compared to calendar year 1990, and may contain interim goals." This section amends the inventory requirements of EPCA at 42 USCA § 6324 to not only estimate the oil and gas resources underlying Federal lands, but also document and evaluate impediments and restrictions to the development of oil and gas resources.

L: Guidance Related to Assessment, Inventory, and Monitoring

MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
Strikethrough indicates the Manual Section has been deleted according to Pages in Effect, 02/14/2006							
	General Administration						
1162	Analysis and Evaluation						
1200	**Administrative Management**						
1240	Evaluation Program						
H-1240-1	Handbook for Conduction Evaluations						
1241	General Management Evaluations						
1261	Automation/ Information Resources Management Modernization (AIM)	1-1613	03/08/0993	This handbook provides an overview of BLM's overall AIM process. AIM is an ongoing initiative to modernize BLM's business. "Business" includes activities such as processing land use and administrative applications and collecting, managing, storing, and using a variety of resource management and other data and information.			

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
1283	Data Administration and Management	1-1678	11/25/2002	Provides poicy and guidelines in the effective management of data collected and used to support BLM mission. This policy is to ensure the data BLM collects, uses, and disseminates relates to its mission. Requires controls to establish standards, quality control, and assurance for data oversight and monitoring.	375 DM 376 DM 378 DM 380 DM 511 DM 1220 ~~1261~~ ~~1264~~ 1270 1271 1274 1275 1278 9160	H-1270-1 H-1270-2	
1600	**Planning, Programming, and Budgeting**						
1601	Land Use Planning	1-1666	11/22/2002	Provides guidance for preparing new Resource Management Plans (RMPs), plan revisions, plan amendments, other equivalent plans, and subsequent implementation-level plans. This guidance integrates LUP with NEPA.	512 DM 516 DM 6840 8120 8160 8300	H-1601-1 H-1790-1 H-8160-1 H-8410-1 H-9211-1 H-9214-4	
H-1601-1	Land Use Planning Handbook	1-1693	03/11/2005	Provides guidance for preparing, revising, amending, and maintaining land use plans. Provides guidance for developing subsequent implementation plans and decisions.	DM 512 DM 516 1283 1613 6840 7000 8110 8120 8300	H-1790-1 H-4180-1 H-8120-1	TR 1734-6 TR 1734-7

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
1613	Areas of Critical Environmental Concern	1-1541	9/29/1988	Provides policy and procedural guidance on identification, evaluation, and designation of ACEC in RMPs and monitoring and management of same.	1601 1602 1613 1614 1616 1617 1618 1619 ~~1620~~ ~~1621~~ ~~1622~~ ~~1623~~		
1617	Resource Management Plan Approval, Use, and Modification	1-1363	09/29/1988	Refers reader to superceeding Manual Section 1601 for plan approval and administrative review information.	1601		
H-1624-1	Planning for Fluid Mineral Resources	1-1583	05/07/1990	Provide guidance on for fluid mineral determinations required in RMPs and EA or EIS guidance.	1601 ~~1624~~ 1790 3031 3100 3200	H-1790-1 H-3100 H-3200	
1700	**Program Management**						
1734	Inventory and Monitoring Coordination	1-1335	07/27/83	Establishes Bureauwide objectives, policies, and standards for coordination of resource inventory, monitoring, and evaluation activities.			

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
1737	Riparian-Wetland Area Management	1-1611	10/12/1992	Describes the policies, responsibilities, and guidance for the identification, protection, restoration , and maintenance, of fresh, brackish, and saline water wetland areas. Riparian areas are a form of wetland transitional between permanently saturated wetlands and upland areas.	1613 ~~1620~~ ~~1621~~ ~~1622~~ ~~1623~~ ~~1624~~ ~~1625~~ 1734 1740 4100 6720 6840 7200 ~~7221~~ ~~8550~~ 8560 8561	H-4120-1 H-4410-1 H-8550-1 H-8560-1	~~TR 4400-4~~ ~~TR 1737-1~~ ~~TR 1737-2~~ TR 1737-3 ~~TR-1737-4~~ ~~TR 1737-5~~ TR 1737-6 TR 1737-7

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED			HANDBOOKS CITED		TECHNICAL REFERENCES CITED
1740	Renewable Resource Improvements and Treatments	1-1427	09/03/1985	Identify objectives, policies, and standards that are common and apply to planning, analyzing, constructing, maintaining, replacing, and/or modifying renewable resource improvements and treatment for the forestry range management, soil, water, air, fish and wildlife, and wild horse and burro programs to achieve management objectives on BLM managed lands.	~~1741~~	~~1742~~	~~1743~~	H-1740-1	H-1741-1	
					~~1112~~	1510	1601	H-1742-1	~~H-1743-1~~	
					~~1617~~	~~1619~~	~~1620~~	H-4120-1	H-9172-1	
					~~1621~~	~~1622~~	~~1623~~	H-9172-2	H-9177-1	
					~~1624~~	~~1625~~	2920	H-9172-2	H-9177-3	
					4100	~~4120~~	5000			
					5400	6500	6780			
					6840	7000	9100			
					~~9101~~	9102	9103			
					9104	9114	~~9132~~			
					9172	9177				
					9182	~~9183~~	9184			
					9220	~~9222~~				

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
H-1740-1	Renewable Resource Improvement and Treatment Guidelines and Procedure	1-1509	12/07/1987	Supplements MS 1740 by incorporating permanent guidance on rangeland, wildlife, and watershed investments.			
1742	Emergency Fire Rehabilitation	1-1423	08/08/1985	Provides objectives, policies, procedural directions, and standards for Emergency Fire Rehabilitation.	1740		~~4400-1~~ - -
H-1742-1	Emergency Fire Rehabilitation	1-1424	08/08/1985	Describes the process to be used to develop a Normal Fire rehabilitation Plan (NFRP) based on past fire occurrence, potential damage to resource values, land-use planning objectives, decisions, and available resource data			

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1745	Introduction, Transplant, Augmentation, Reestablishment of Fish, Wildlife, and Plants	1-1603	03/26/1992	Provides guidance on the introduction of exotic species and the transplant, augmentation, reestablishment of native species and naturalized exotic species. Exotic organisms for use as Biological control Agents must meet the requirements outlined in MS 9014.	1203 1601 ~~1611~~ 1613 ~~1614~~ ~~1617~~ ~~1619~~ ~~1621~~ ~~1622~~ 1737 1740 1790 4120 6500 6521 6720 6780 6830 8560 9014	H-8550-1 H-1790-1 H-8560-1	
1790	National Environmental Policy Act Handbook	1-1547	10/25/1988	Provides instructions for complying with the CEQ Regulations for implementing the procedural provisions of NEPA and the BLM's DM 516.	516 DM 1323 1601 1617		
3000	**Minerals Management**						
3031	Energy and Mineral Resource Assessment						

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
3060	Mineral Reports - Preparation and Review	3-284	04/07/1994	Provides minimum standards for preparing, reviewing, and approving energy and mineral resources reports in response to a specific action or application. This is not intended to provide guidance on how to conduct technical evaluations which is covered in individual program manuals and handbooks.	3021 3031 3070 3891	H-3890-1	
3070	Mineral Economic Evaluation	3-254	10/15/1989				
H-3070-1	Economic Evaluation of Coal Properties	3-285	04/07/1994				
3100	**Oil and Gas Leasing**						
3200	**Geothermal Resources Leasing**						
3400	**Coal Management**						
3400	Coal Management	3-146	12/18/1986				

MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
Strikethrough indicates the Manual Section has been deleted according to Pages in Effect, 02/14/2006							
3486	Inspection and Enforcement, Production Verification, and Appeals	3-256	07/27/1990				
3500	**Leasing of Solid Minerals other than Coal and Oil Shale**						
3500	Leasing of Solid Minerals other than Coal and Oil Shale	3-136	09/24/1986				
3598	Inspection and Enforcement Production Verification, and Appeals						
3700	**Multiple Use; Mining***						
3800	**Mining Claims under the General Mining Laws**						
3852	Deferment of Assessment Work						
4000	**Range Management**						

MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
Strikethrough indicates the Manual Section has been deleted according to Pages in Effect, 02/14/2006							
4010	Range Management Program Records	4-87	07/26/1988	Provides procedural direction and standards for establishing and maintaining range management program records. Includes documents necessary for reporting on ecological status and trends.	4100	H-4010-1	
H-4010-1	Range Management Records	4-88	07/26/1988	Provides direction and standards for the management of range program recordkeeping.	1220 ~~1272~~ ~~1279~~		
4100	**Grazing Administration - Exclusive of Alaska**						
4100	Qualifications and Preference	4-96	02/16/1989	Sets forth the objectives and policies for BLM livestock grazing administration and management program, exclusive of Alaska	~~1784~~ ~~4160~~ ~~1621~~ ~~1622~~ 4400*		
4180	Rangeland Health Standards	4-106	01/19/2001	Describes the authorities, objectives, and policies that guide the implementaion of the Healthy Rangeland Initiative.	1601* 6840	H-1601-1 H-4180-1	

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H-4180-1	Rangeland Health Standards Manual Handbook	4-107	1/19/2001	Provides specific direction for implementing the policies listed in the 4180 MS and the Healthy Rangelands Initiative.	4180	H-1601-1	TR-1730-1 TR -1734-3 TR-1734-4 TR -1734-8 TR-1737-3 TR -1737-5 TR-1737-7 TR -1737-8 TR-1737-9 TR -1737-10 TR-1737-11 TR -1737-12 TR-1737-13 TR -1737-15 TR-1737-16 TR -4400-2 TR-4400-5 TR -4400-7 TR-4400-8 TR -4400-9
4400	**Rangeland Inventory, Monitoring, and Evaluation**						

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
4400	Rangeland Monitoring and Evaluation	4-97	11/28/1989	Establishes policies, objectives, and internal operating procedures for applying and reporting rangeland inventory, monitoring, and evaluation relating to the effects of rangeland management actions on soils, vegetation, and water resources.	~~1622~~ 1734 4100* ~~4110~~ ~~4160~~ ~~4410~~ -	H-4110-1 H-4130-1 H-4160-1 H-4400-1 H-4410-1	
H-4400-1	Rangeland Monitoring and Evaluation	4-98	11/28/1989	Provides procedural direction and standards for rangeland monitoring and evaluation on the public lands or other lands	~~1622~~ 1734 -		~~TR -4400-1~~ TR -4400-2 ~~TR -4400-3~~ ~~TR -4400-4~~ TR -4400-7
H-4410-1	National Range Handbook	4-101	05/25/1990	Guidance on ecological site concept, data collection procedures, and how the ecological site data are used in the rangeland management program			SITEFORMS CS Rng Condition Class Hydrologic Conditions SCS-Range-417
4700	**Wild Free-Roaming Horse and Burro Management**						
4710	Management Considerations Protection	4-90	11/23/1988		1601 ~~1611~~ ~~1612~~ 1613 ~~1614~~ ~~1615~~ ~~1616~~ ~~1617~~ ~~1622~~		

MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
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5000	**Forest Management**						
5000-1	Forest Management (Public Domain)	5-139	10/28/1991	Provides guidance for maintenance, restoration, imporvement, harvest, and replacement of forest vegetation and management for desired plant communities.	1601 ~~1622~~		
5100	**Forest Management Plans***						
5200	**Forest Management Program Development***						
5251	Timber Production Capacity Classification						
5300	**Timber Measurement**						
5310	Timber Cruising	5-114	08/03/1982	Provides guidance for policies, standards, and guidelines for applying timber cruise measurement systems	5300		
5400	**Sales of Forest Products**						
H-5400-2	Timber Sale Information System						

MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
5700	**Forest Development**						
5703	Records and Annual Reports						
5705	Regeneration Stocking Surveys						
6300	**Wildlife Management***						
6100	National Landscape Conservation System						
6200	National Conservation Areas, National Monuments, National Scenic and Historic Trails						
6310	Wilderness Inventory and Study Procedures						
6500	**Wildlife Management***						

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
6500	Wildlife Management	6-114	6/17/1988	Provide guidance for the wildlife and fisheries program. Program authorities are summarized, key policies identified, and program goals and objectives outlined	~~1500~~ ~~1514~~ ~~1622~~ ~~1741~~ 6600 6720 ~~6740~~ 6780 ~~6820~~ 6840		
6501	Wildlife Reports	6-70	10/07/1980	To obtain an estimate of wildlife habitat and population conditions, trends, and management status, and to provide data on the Bureau's wildlife program accomplishments for BLM administered lands.	6500 ~~6620~~ 6602		
6600	**Fish, Wildlife, and Special Status Plant Resources Inventory and Monitoring**						
6600	Fish, Wildlife, and Special Status Plant Resources Inventory and Monitoring	6-117	08/02/1990	Provide policy and direction for conducting inventory and monitoring of fish, wildlife, and special status plants, and supplement guidance in BLM manual Section 1734-Inventory and Monitoring Coordination	~~1622~~ 1734 4400* 6500 6521* 6522* 6525 6840	H-4400-1	~~TR 1737-2~~ TR 4400 TR 4410-1 IHICS RAIDS TEDS WORDS

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
6602	Integrated Habitat Inventory and Classification System	6-87	03/26/1982	Establishes the Integrated Habitat Inventory and Classification System (IHICS) to be used for managing wildlife resources	4412 6610 6630 6740		DED Species Codes
6610	Wildlife Inventory	6-41	09/10/1973				
6631	Requirements	6-50	09/23/75				
6632	Preparatory Information						
6633	Field Procedure						
6634	Inspection Methods						
6635	Habitat Condition and Trend						
6674	Water Analysis for Fisheries	6-50	09/23/1975	Provides instructions for collections and analysis of water samples as part of an intensive inventory and analysis.			
7000	**Soil, Water, and Air Management**						
7000	Soil, Water, and Air Management	7-85	03/08/1984	Provides policy and guidance for the management of soil, water, and air resources and watershed values.			

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
7100	Soil Resource Management	7-87	08/15/1984	Provides policy on the conduct of soil surveys and their related functions.	7000		
7200	**Water Resources**						
7221	Floodplain Management						
7240	Water Quality						
7250	Water Rights						
7300	**Air Resources***						
7316	Ground Water Hydrology						
8000	**Recreation Programs***						
8100	**Cultural and Resource Management**						
8110	Cultural Resource Identification						
8111	Cultural Resource Inventory and Evaluation						
8200	**Natural History Resource Management***						

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8300	**Recreation Management**						
8310	Recreation Inventory						
8320	Planning for Recreation Resources						
8322	Recreation Area Management Plans						
8323	Recreation Project Planning						
8340	Off-Road Vehicles						
8351	Wild & Scenic Rivers - Policy and Program Direction for Identification, Evaluation , and Management						
8400	**Visual Resource Management**						
8410	Visual Resource Inventory						

MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED

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MANUAL SECTION	TITLE	RELEASE	DATE	PURPOSE	MANUAL SECTIONS CITED	HANDBOOKS CITED	TECHNICAL REFERENCES CITED
H-8410-1	Visual Resource Inventory						
8500	**Wilderness Management***						
9200	**Protection**						
9211	80	9-273	06/02/1987	An operational plan which describes the purpose, resource and fire objectives, and operational procedures required to properly plan, safely implement, monitor, and evaluate fire and resource objectives for this treatment.	1734 1740 4400 9210 9218		
H-9211-1	Fire Management Activity Plan Procedures						
9500	**Social and Economic Analysis***						
9521	Benefit-Cost Analysis						
9522	Cost-Effectiveness Analysis						
9530	Techniques of Economic Analysis						
9553	Socioeconomic Data System						

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9600	**Geo-Sciences (formerly Cadastral Survey)**						

M: Field Techniques Identified for Monitoring Survey

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Fire/Fuels	Departure	Interagency FRCC Guidebook	Landscape	To characterize ecological condition in fire management planning and before and after fuels treatments.		http://www.frcc.gov
Fire/Fuels	Fire Regime Condition Class	Interagency FRCC Guidebook	Landscape	To characterize ecological condition in fire management planning and before and after fuels treatments.		http://www.frcc.gov
Forest/ Woodland Habitat	Fire Regime Condition Class	Interagency FRCC Guidebook	Landscape	The Fire Regime Condition Class (FRCC) method provides tools for fire, vegetation, and fuels assessment and management at both the landscape and stand levels. These methods are used to describe general landscape fire regime and vegetation-fuel characteristics.	INTERAGENCY FIRE REGIME CONDITION CLASS GUIDEBOOK	http://www.frcc.gov
Rangeland/ Upland Habitat	Sage Grouse Assessment Framework		Landscape			
Rangeland/ Upland Habitat	Wyoming Basin Assessment		Landscape			

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Aquatic Habitat	Channel Classification	Montgomery-Buffington	Site	The Montgomery and Buffington stream classification system is used primarily for streams in the Pacific Northwest. The hierarchy of classification is based on a range of rivers that are sediment limited to transport limited and placed into bedrock, alluvial, and colluvial groups, respectively. Stream groups include colluvial, bedrock, cascade, step-pool, plane-bed, pool-riffle, regime, and braided. River characteristics such as bed material, pattern, transport/depositional reach, dominant roughness features, dominant sediment sources, dominant storage features, slope, confinement, and pool spacing are used in the classification. (TR 1737-21)		
Aquatic Habitat	Channel Classification	Rosgen	Site	The Rosgen classification system is designed to: predict a river's behavior from its appearance; develop a specific hydraulic and sediment relations for a given morphological channel type and state; provide a mechanism to extrapolate site-specific data collected on a given stream reach to those of similar character; and provide a consistent and reproducible frame of reference of communication for those working with river systems in a variety of professional disciplines. (TR 1737-21)	RIPARIAN AND WETLAND CLASSIFICATION	http://www.blm.gov/nstc/library/pdf/1737-21.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
ES or BAR	Cover	Cover Board	Site	The Cover Board method uses a profile board or density board to estimate the vertical area of a board covered by vegetation from a specified distance away. This technique is designed to evaluate changes in the vegetation structure over time. Quantifying the vegetation structure for statistical comparison was described by Nudds (1977). It is important to establish a photo plot and take both close-up and general view photographs. (TR 1734-4)	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
ES or BAR	Cover	Daubenmire	Site	The Daubenmire method consists of systematically placing a 20- x 50-cm quadrat frame along a tape on permanently located transects. The following vegetation attributes are monitored using the Daubenmire method: • Canopy cover • Frequency • Composition by canopy cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
ES or BAR	Cover	Line Intercept	Site	The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. Foliar and basal cover can be monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
ES or BAR	Cover	Line Point Intercept	Site	The Point-Intercept method consists of employing a sighting device or pin/point frame along a set of transects to arrive at an estimate of cover. It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
ES or BAR	Cover	Quadrat	Site	Quadrat frequency consists of observing quadrats along transects, with quadrats systematically located at specified intervals along each transect. Basal cover and general cover categories (including litter) are monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
ES or BAR	Cover	Step Point	Site	The Step-Point Method involves making observations along a transect at specified intervals, using a pin to record cover "hits." It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
ES or BAR	Density	Quadrat	Site	Quadrat frequency consists of observing quadrats along transects, with quadrats systematically located at specified intervals along each transect (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
ES or BAR	Frequency	Nested Plot Frequency	Site	The nested plot concept is a simple approach to collecting data on two or more different sized plots at one time. Several different sized plots are placed inside each other in a smallest to largest sequence. This method resolves the following limitations of quadrat sampling: one size plot is usually not adequate to collect frequency data on all the important species within a community, plot size appropriate for one species may not be appropriate for another, and for each species occurring on a site, there is a limited range of plot sizes capable of producing frequency percentages between 20 and 80 percent (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
ES or BAR	Production	Comparative Yield	Site	This method is used to estimate total standing crop or production of a site. The total production in a sample quadrat is compared to one of five reference quadrats; relative ranks are recorded rather than estimating the weight directly. It is important to establish a photo plot and take both close-up and general view photographs.	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
ES or BAR	Production	Double Weight Sampling	Site	This technique has been referred to by some as the Calibrated Weight Estimate method. The objective of this method is to determine the amount of current-year above-ground vegetation production on a defined area. It is important to establish a photo plot and take both close-up and general view photographs (TR 1737-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
ES or BAR	Production	Harvest	Site	In this method all plants in all plots are harvested. Harvest, weigh, and record the weight of each species in the plots selected for harvesting. Harvest all parts of all plants within the plot. Exclude all portions of all plants outside the vertical projection of the plot (TR 1734-7).	ECOLOGICAL SITE INVENTROY (TR 1734-7)	http://www.blm.gov/nstc/library/pdf/1734-7.pdf
Forest/ Woodland Habitat	Stand Exam		Site			
Rangeland/ Upland Habitat	Composition	Dry Weight	Site	The Dry Weight Rank method is used to determine species composition. It consists of observing various quadrats and ranking the three species which contribute the most weight in the quadrat. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Rangeland/ Upland Habitat	Cover	Cover Board	Site	The Cover Board method uses a profile board or density board to estimate the vertical area of a board covered by vegetation from a specified distance away. This technique is designed to evaluate changes in the vegetation structure over time. Quantifying the vegetation structure for statistical comparison was described by Nudds (1977). It is important to establish a photo plot and take both close-up and general view photographs. (TR 1734-4)	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Cover	Daubenmire	Site	The Daubenmire method consists of systematically placing a 20- x 50-cm quadrat frame along a tape on permanently located transects. The following vegetation attributes are monitored using the Daubenmire method: • Canopy cover • Frequency • Composition by canopy cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Rangeland/ Upland Habitat	Cover	Line Intercept	Site	The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. Foliar and basal cover can be monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Rangeland/ Upland Habitat	Cover	Line Point Intercept	Site	The Point-Intercept method consists of employing a sighting device or pin/point frame along a set of transects to arrive at an estimate of cover. It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Cover	Quadrat	Site	Quadrat frequency consists of observing quadrats along transects, with quadrats systematically located at specified intervals along each transect. Basal cover and general cover categories (including litter) are monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Rangeland/ Upland Habitat	Cover	Step Point	Site	The Step-Point Method involves making observations along a transect at specified intervals, using a pin to record cover "hits." It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Rangeland/ Upland Habitat	Density	Quadrat	Site	Quadrat frequency consists of observing quadrats along transects, with quadrats systematically located at specified intervals along each transect (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Frequency	Nested Plot Frequency	Site	The nested plot concept is a simple approach to collecting data on two or more different sized plots at one time. Several different sized plots are placed inside each other in a smallest to largest sequence. This method resolves the following limitations of quadrat sampling: one size plot is usually not adequate to collect frequency data on all the important species within a community, plot size appropriate for one species may not be appropriate for another, and for each species occurring on a site, there is a limited range of plot sizes capable of producing frequency percentages between 20 and 80 percent (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Rangeland/ Upland Habitat	Production	Comparative Yield	Site	This method is used to estimate total standing crop or production of a site. The total production in a sample quadrat is compared to one of five reference quadrats; relative ranks are recorded rather than estimating the weight directly. It is important to establish a photo plot and take both close-up and general view photographs.	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Rangeland/ Upland Habitat	Production	Double Weight Sampling	Site	This technique has been referred to by some as the Calibrated Weight Estimate method. The objective of this method is to determine the amount of current-year above-ground vegetation production on a defined area. It is important to establish a photo plot and take both close-up and general view photographs (TR 1737-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Production	Harvest	Site	In this method all plants in all plots are harvested. Harvest, weigh, and record the weight of each species in the plots selected for harvesting. Harvest all parts of all plants within the plot. Exclude all portions of all plants outside the vertical projection of the plot (TR 1734-7).	ECOLOGICAL SITE INVENTROY (TR 1734-7)	http://www.blm.gov/nstc/library/pdf/1734-7.pdf
Rangeland/ Upland Habitat	Seral Status	Ecological Site Inventory (ESI)	Site	This technique is to define reference conditions in the land health assessment process, to set vegetation objectives in land use plans, and to estimate seral status to meet PRIA reporting requirements.	ECOLOGICAL SITE INVENTROY (TR 1734-7)	http://www.blm.gov/nstc/library/pdf/1734-7.pdf
Rangeland/ Upland Habitat	Structure	Community Structure Analysis (CSA)	Site			
Rangeland/ Upland Habitat	Structure	Cover Board	Site	The Cover Board method uses a profile board or density board to estimate the vertical area of a board covered by vegetation from a specified distance away. This technique is designed to evaluate changes in the vegetation structure over time. Quantifying the vegetation structure for statistical comparison was described by Nudds (1977). It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Structure	Robel Pole	Site	This method is used for determining standing plant biomass on an area. It has primarily been used to determine the quality of nesting cover for birds on the Great Plains. This method is applicable to other ecosystems throughout the western U.S. where height and vertical obstruction of cover are mportant. It is important to establish a photo plot and take both close-up and general view photographs.	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Rangeland/ Upland Habitat	Utilization	Cole Browse	Site	The Cole Browse Method is used to collect utilization data on browse species. This method provides data on age and form class, availability and hedging, estimated utilization, and growth and use indexes for the browse component of the plant community. These data are used to make annual utilization and trend estimates.	UTILIZATION STUDIES AND RESIDUAL MEASUREMENTS (TR 1734-3)	http://www.blm.gov/nstc/library/pdf/utilstudies.pdf
Rangeland/ Upland Habitat	Utilization	Stubble Height	Site	The concept of this method is to measure stubble height, or height (in centimeters or inches) of herbage left ungrazed at any given time. This method, because of its simple application, is becoming a well-accepted method for expressing rangeland use. This method would be used after stubble height standards for specific plant communities had been developed.	UTILIZATION STUDIES AND RESIDUAL MEASUREMENTS (TR 1734-3)	http://www.blm.gov/nstc/library/pdf/utilstudies.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Utilization	Paired Plot	Site	Under the Paired Plot Method, forage from protected and unprotected plots is clipped and weighed at the end of the use period. The difference between these two weights represents the amount of forage consumed or otherwise destroyed during that period. This method is for suitable for all vegetation growth forms.	UTILIZATION STUDIES AND RESIDUAL MEASUREMENTS (TR 1734-3)	http://www.blm.gov/nstc/library/pdf/utilstudies.pdf
Rangeland/ Upland Habitat	Utilization	Key Species	Site	This technique is a combination of the Landscape Appearance Method and the Ocular Estimate Method. Utilization levels are based on an ocular estimate of the amount of forage removed by weight on individual key species and observations are recorded in one of seven utilization classes. Primary use: perennial grasses, forbs, and/or browse plants.	UTILIZATION STUDIES AND RESIDUAL MEASUREMENTS (TR 1734-3)	http://www.blm.gov/nstc/library/pdf/utilstudies.pdf
Rangeland/ Upland Habitat	Utilization	Height-Weight	Site	The Height-Weight Method involves the measurement of heights of ungrazed and grazed grass or grasslike plants to determine average utilization. Measurements of plant heights recorded along transects are converted to percent of weight utilized by means of a utilization gauge (Lommasson and Jensen 1943). The utilization gauge is developed from heightweight relationship curves. This method for bunch or rhizomatous/sod-forming grasses or grasslike species (TR 1734-3).	UTILIZATION STUDIES AND RESIDUAL MEASUREMENTS (TR 1734-3)	http://www.blm.gov/nstc/library/pdf/utilstudies.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Utilization	Grazed-Class	Site	The Grazed-Class Method uses photo guides of key species to make utilization estimates. These estimates reflect herbage removed but also show herbage remaining (TR 1734-3). This method adapted for use on perennial grass, perennial grass-forb, and grass-shrub rangelands	UTILIZATION STUDIES AND RESIDUAL MEASUREMENTS (TR 1734-3)	http://www.blm.gov/nstc/library/pdf/utilstudies.pdf
Rangeland/ Upland Habitat	Vigor	Adequate root development	Site			
Rangeland/ Upland Habitat	Vigor	Reproductive tiller	Site			
Rangeland/ Upland Habitat	Vigor	Seed head production	Site			
Soil or Soil Biota	Cover	Cover Board	Site	The Cover Board method uses a profile board or density board to estimate the vertical area of a board covered by vegetation from a specified distance away. This technique is designed to evaluate changes in the vegetation structure over time. Quantifying the vegetation structure for statistical comparison was described by Nudds (1977). It is important to establish a photo plot and take both close-up and general view photographs. (TR 1734-4)	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Soil or Soil Biota	Bare Ground	Line Point Intercept	Site	The Point-Intercept method consists of employing a sighting device or pin/point frame along a set of transects to arrive at an estimate of cover. It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Soil or Soil Biota	Cover	Daubenmire	Site	The Daubenmire method consists of systematically placing a 20- x 50-cm quadrat frame along a tape on permanently located transects. The following vegetation attributes are monitored using the Daubenmire method: • Canopy cover • Frequency • Composition by canopy cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Soil or Soil Biota	Cover	Line Intercept	Site	The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. Foliar and basal cover can be monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Soil or Soil Biota	Cover	Line Point Intercept	Site	The Point-Intercept method consists of employing a sighting device or pin/point frame along a set of transects to arrive at an estimate of cover. It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Soil or Soil Biota	Cover	Quadrat	Site	Quadrat frequency consists of observing quadrats along transects, with quadrats systematically located at specified intervals along each transect. Basal cover and general cover categories (including litter) are monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Soil or Soil Biota	Cover	Step Point	Site	The Step-Point Method involves making observations along a transect at specified intervals, using a pin to record cover "hits." It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Soil or Soil Biota	Slope Stability Analysis	Photographs	Site			
Soil or Soil Biota	Soil Chemical Properties	Electrical conductivity (EC)	Site			

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Soil or Soil Biota	Soil Chemical Properties	pH	Site			
Soil or Soil Biota	Soil Chemical Properties	Sodium Absorption Ratio (SAR)	Site			
Soil or Soil Biota	Soil compaction	Densiometry	Site			
Soil or Soil Biota	Soil compaction	Gravimetric	Site			
Soil or Soil Biota	Soil compaction	Resistance (penetrometers)	Site			
Soil or Soil Biota	Soil Moisture	Gravimetric	Site			
Soil or Soil Biota	Soil Moisture	Meter	Site			
Soil or Soil Biota	Soil Survey and/or Investigations	Ecological Site Inventory (ESI)	Site	This technique is to define reference conditions in the land health assessment process, to set vegetation objectives in land use plans, and to estimate seral status to meet PRIA reporting requirements.	ECOLOGICAL SITE INVENTROY (TR 1734-7)	http://www.blm.gov/nstc/library/pdf/1734-7.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Special Status Plants	Composition	Dry Weight	Site	The Dry Weight Rank method is used to determine species composition. It consists of observing various quadrats and ranking the three species which contribute the most weight in the quadrat. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Cover	Cover Board	Site	The Cover Board method uses a profile board or density board to estimate the vertical area of a board covered by vegetation from a specified distance away. This technique is designed to evaluate changes in the vegetation structure over time. Quantifying the vegetation structure for statistical comparison was described by Nudds (1977). It is important to establish a photo plot and take both close-up and general view photographs. (TR 1734-4)	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Cover	Daubenmire	Site	The Daubenmire method consists of systematically placing a 20- x 50-cm quadrat frame along a tape on permanently located transects. The following vegetation attributes are monitored using the Daubenmire method: • Canopy cover • Frequency • Composition by canopy cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Special Status Plants	Cover	Line Intercept	Site	The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. Foliar and basal cover can be monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Cover	Line Point Intercept	Site	The Point-Intercept method consists of employing a sighting device or pin/point frame along a set of transects to arrive at an estimate of cover. It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Cover	Quadrat	Site	Quadrat frequency consists of observing quadrats along transects, with quadrats systematically located at specified intervals along each transect. Basal cover and general cover categories (including litter) are monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Special Status Plants	Cover	Step Point	Site	The Step-Point Method involves making observations along a transect at specified intervals, using a pin to record cover "hits." It measures cover for individual species, total cover, and species composition by cover. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Density	Quadrat	Site	Quadrat frequency consists of observing quadrats along transects, with quadrats systematically located at specified intervals along each transect (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Frequency	Nested Plot Frequency	Site	The nested plot concept is a simple approach to collecting data on two or more different sized plots at one time. Several different sized plots are placed inside each other in a smallest to largest sequence. This method resolves the following limitations of quadrat sampling: one size plot is usually not adequate to collect frequency data on all the important species within a community, plot size appropriate for one species may not be appropriate for another, and for each species occurring on a site, there is a limited range of plot sizes capable of producing frequency percentages between 20 and 80 percent (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Special Status Plants	Production	Comparative Yield	Site	This method is used to estimate total standing crop or production of a site. The total production in a sample quadrat is compared to one of five reference quadrats; relative ranks are recorded rather than estimating the weight directly. It is important to establish a photo plot and take both close-up and general view photographs.	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Production	Double Weight Sampling	Site	This technique has been referred to by some as the Calibrated Weight Estimate method. The objective of this method is to determine the amount of current-year above-ground vegetation production on a defined area. It is important to establish a photo plot and take both close-up and general view photographs (TR 1737-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Production	Harvest	Site	In this method all plants in all plots are harvested. Harvest, weigh, and record the weight of each species in the plots selected for harvesting. Harvest all parts of all plants within the plot. Exclude all portions of all plants outside the vertical projection of the plot (TR 1734-7).	ECOLOGICAL SITE INVENTROY (TR 1734-7)	http://www.blm.gov/nstc/library/pdf/1734-7.pdf
Special Status Plants	Structure	Community Structure Analysis (CSA)	Site			

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Special Status Plants	Structure	Cover Board	Site	The Cover Board method uses a profile board or density board to estimate the vertical area of a board covered by vegetation from a specified distance away. This technique is designed to evaluate changes in the vegetation structure over time. Quantifying the vegetation structure for statistical comparison was described by Nudds (1977). It is important to establish a photo plot and take both close-up and general view photographs. (TR 1734-4)	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Structure	Robel Pole	Site	This method is used for determining standing plant biomass on an area. It has primarily been used to determine the quality of nesting cover for birds on the Great Plains. This method is applicable to other ecosystems throughout the western U.S. where height and vertical obstruction of cover are mportant. It is important to establish a photo plot and take both close-up and general view photographs.	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Special Status Plants	Utilization	Various techniques.	Site			
Rangeland/ Upland Habitat	Rangeland Health	Estimation of Apparent Trend	Watershed/Allotment		INTERPRETING INDICATORS OF RANGELAND HEALTH (TR 1734-6)	http://www.blm.gov/nstc/library/pdf/1734-6rev05.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Rangeland Health	Interpreting Indicators of Rangeland Health	Watershed/Allotment	This is a qualitative assessment of soil/site stability, hydrologic function, and biotic integrity. The product of this assessment is not a single rating of rangeland health, but an assessment of the three components.	INTERPRETING INDICATORS OF RANGELAND HEALTH (TR 1734-6)	http://www.blm.gov/nstc/library/pdf/1734-6rev05.pdf
Soil or Soil Biota	Rangeland Health	Interpreting Indicators of Rangeland Health	Watershed/Allotment	To identify the condition or functionality of the land. This information is then used to evaluate whether standards are being achieved, and if not, to help identify the causal factors.		http://www.blm.gov/nstc/library/pdf/1734-6rev05.pdf
Aquatic Habitat	Several Parameters	PACFISH/ INFISH Biological Opinions (PIBO)		Developed in 1998 in response to monitoring needs addressed in the Biological Opinion for bull trout (USFWS 1998) and steelhead (NMFS 1995) (Kershner et al. 2004). The primary objective is to determine whether priority biological and physical attributes, processes, and functions of riparian and aquatic systems are being degraded, maintained, or restored in the PIBO area.		http://www.fs.fed.us/biology/fishecology/emp/ http://www.fs.fed.us/biology/resources/pubs/feu/2004_final_aremp_protocol.pdf
Aquatic Habitat	Functioning Condition Assessment	Proper Functioning Condition		PFC is a qualitative method for assessing the conditoin of riparian wetland areas. The PFC assessment refers to a consistent approach for considering hydrology, vegetation, and erosion deposition (soils) attributes and processes to assess the condition of riparian wetland areas. (TR 1737-9&16)		http://www.blm.gov/nstc/library/techref.htm

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Aquatic Habitat	Habitat features (spawning gravel, etc.)	Hankin-Reeve				
ES or BAR	Cover	Community Structure Analysis (CSA)				
ES or BAR	Density	Community Structure Analysis (CSA)				
ES or BAR	Frequency	?Other Measures of Frequency?				
ES or BAR	Frequency	Community Structure Analysis (CSA)				
ES or BAR	Structure	Community Structure Analysis (CSA)				
ES or BAR	Vigor	?Other Measures of Vigor?				
ES or BAR	Vigor	Adequate root development				
ES or BAR	Vigor	Reproductive tiller				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
ES or BAR	Vigor	Seed head production				
ES or BAR		Photo plots				
Fire/Fuels	Bare Ground	FIREMON				
Fire/Fuels	Fire-Induced Plant Mortality	Tree Data		The Tree Data (TD) methods are used to sample individual live and dead trees on a fixed-area plot to estimate tree density, size, and age class distributions before and after fire in order to assess tree survival and mortality rates.	FIREMON: FIRE EFFECTS MONITORING AND INVENTORY SYSTEM	http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true
Fire/Fuels	Burn Severity	Composite Burn Index		This is a scaled index gauging the magnitude of ecological change caused by fire. It entails a relatively large plot; independent severity ratings for individual strata, and synoptic scores for the whole plot area. Ratings consider such criteria as color and condition of substrates, amount of fuel and vegetation consumed, regeneration from pre-fire vegetation, establishment of new seral species, and blackening or scorching of trees.	Firemon	http://www.fire.org
Fire/Fuels	Burn Severity	Normalized Burn Ratio				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Fire/Fuels	Canopy Cover	Cover Frequency		The Cover/Frequency (CF) method is designed to sample within plot variation and quantify changes in plant species cover, height, and frequency over time. This method is primarily used when the manager wants to monitor statistically significant changes in plant species cover, height, and frequency. The CF sampling method is most appropriate for vascular and non-vascular plants less than 3 feet (1 m) in height.	FIREMON: FIRE EFFECTS MONITORING AND INVENTORY SYSTEM	http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true
Fire/Fuels	Canopy Cover	Line Intercept	Site	The FIREMON Line Intercept (LI) method is used to assess changes in plant species cover for a macroplot. This method uses multiple line transects to sample within plot variation and quantify statistically valid changes in plant species cover and height over time. The LI method can be used in conjunction with cover-frequency transects when vegetation over 3 feet (1 m) exists. Line intercept can also be used to calibrate ocular estimates of shrub cover when the Species Composition (SC) method is used.	FIREMON: FIRE EFFECTS MONITORING AND INVENTORY SYSTEM	http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true
Fire/Fuels	Canopy Cover	Point Cover		The FIREMON Point Intercept (PO) method is used to assess changes in plant species cover or ground cover for a macroplot. This method uses a narrow diameter sampling pole or sampling pins, placed at systematic intervals along line transects to sample within plot variation and quantify statistically valid changes in plant species cover and height over time.	FIREMON: FIRE EFFECTS MONITORING AND INVENTORY SYSTEM	http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Fire/Fuels	Composition	Species Composition		The FIREMON Species Composition (SC) method is used to provide ocular estimates of cover and height measurements for plant species on a macroplot. The SC method provides plant species composition and cover estimates to describe a stand or plant community and can be used to document changes over time. It is suited for a wide variety of vegetation types and is especially useful in plant communities with tall shrubs or trees. The SC method does not quantify the variability within a plot and cannot be used to detect statistically significant changes over time.	FIREMON: FIRE EFFECTS MONITORING AND INVENTORY SYSTEM	http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true
Fire/Fuels	Cover	FIREMON				
Fire/Fuels	Fire Behavior Variables	Fire Effect Monitoring Guidebook				
Fire/Fuels	Fire Behavior Variables	Fire Behavior		The Fire Behavior (FB) methods are used to describe the behavior of the fire and the ambient weather conditions that influence the fire behavior. Fire behavior methods are not plot based and are collected by fire event and time-date. In general, the fire behavior data are used to interpret the fire effects documented in the plot-level sampling. The Fire Behavior methods are documented observations taken for one fire event, not for the FIREMON macroplots.	FIREMON: FIRE EFFECTS MONITORING AND INVENTORY SYSTEM	http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Fire/Fuels	Site Characteristics	Plot Description		The Plot Description (PD) form is used to describe general characteristics of the FIREMON macroplot to provide ecological context for data analyses. The PD data characterize the topographical setting, geographic reference point, general plant composition and cover, ground cover, fuels, and soils information.	FIREMON: FIRE EFFECTS MONITORING AND INVENTORY SYSTEM	http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true
Fire/Fuels	Fuel Loading	Fuel Load inc. Planar Intersect		The Fuel Load methods (FL) are used to sample dead and down woody debris, depth of the duff/litter profile, estimate the proportion of litter in the profile, and estimate total vegetative cover and dead vegetative cover. Down woody debris (DWD) is sampled using the planar intercept technique based on the methodology developed by Brown (1974). Biomass of DWD, duff, litter and vegetation is calculated using the Analysis Tools software.	FIREMON: FIRE EFFECTS MONITORING AND INVENTORY SYSTEM	http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true
Fire/Fuels	Successional Development	Plot Sampling Methods				
Fire/Fuels		Current Vegetation Survey (CVS)				
Forest/ Woodland Habitat	Disease or Die Off					

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Forest/ Woodland Habitat	Habitat Mapping (i.e. shrub stands)					
Forest/ Woodland Habitat	Habitat Suitability Assessment	Species-Dependent Protocols				
Forest/ Woodland Habitat	Inventory	Forest Inventory and Analysis				
Forest/ Woodland Habitat	Inventory	FORVIS		The Forest Vegetation Information System (FORVIS) is a system for storage, retrieval, and analysis of data about forest lands. The focus of the system is the management of attribute data about vegetation polygons and about associated land management events. The system provides data management and analytical capabilities for inventorying and monitoring vegetation on forested uplands.	FOREST VEGETATION INFORMATION SYSTEM (FORVIS) RELEASE 2.0	http://web.blm.gov/internal/wo-500/cm/securevdds/FORVIS_2-0_VDD_04_25_06.pdf
Forest/ Woodland Habitat	Inventory	Microstorms				
Forest/ Woodland Habitat	Productivity	?Other Measures of Forest Productivity?				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Forest/ Woodland Habitat	Productivity	TPCC				
Forest/ Woodland Habitat	Regeneration Surveys					
Forest/ Woodland Habitat	Vegetation inventory and/or mapping					
Forest/ Woodland Habitat		Current Vegetation Survey (CVS)				
Invasive Weeds	Population growth rate (rate of spread)	Various techniques				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Invasive Weeds	Population (weed species, location, acreage, density, etc.).	Inventory and Mapping				
Invasive Weeds	Treatment effectiveness and effects on non-target	Line Intercept	Site	The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. Foliar and basal cover can be monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Invasive Weeds	Treatment effectiveness and effects on non-target	Quadrat				
Rangeland/ Upland Habitat	Composition	?Other Measures of Composition?				
Rangeland/ Upland Habitat	Current Vegetation Survey (CVS)					

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Frequency	?Other Measures of Frequency?				
Rangeland/ Upland Habitat	Habitat Mapping (i.e. shrub stands)					
Rangeland/ Upland Habitat	Habitat Suitability Assessment	Species-Dependent Protocols				
Rangeland/ Upland Habitat	Vegetation inventory and/or mapping					
Rangeland/ Upland Habitat	Vigor	?Other Measures of Vigor?				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Reg-ional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Rangeland/ Upland Habitat	Various	Photo plots		Photographs can be valuable sources of information in portraying resource values and conditions. Therefore pictures should be taken of all study areas. Use close-up and/or general view pictures with all of the study methods. Comparing pictures of the same site taken over a period of years furnishes visual evidence of vegetation and soil changes. In some situations, photo points could be the primary monitoring tool. All pictures should be in color, regardless of whether they are the primary or secondary monitoring tool (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Riparian	Base Line Data	Aerial Photographs	Site	Provides basic information concepts and procedures associated with using aerial photography to establish baseline data for effective management of riparian wetland areas.(TR 1737-10)	THE USE OF AERIAL PHOTOGRAPHY TO MANAGE RIPARIAN/WETLAND AREAS	http://www.blm.gov/nstc/library/techref.htm
Riparian	Channel Classification	Rosgen	Site	The Rosgen classification system is designed to: predict a river's behavior from its appearance; develop a specific hydraulic and sediment relations for a given morphological channel type and state; provide a mechanism to extrapolate site-specific data collected on a given stream reach to those of similar character; and provide a consistent and reproducible frame of reference of communication for those working with river systems in a variety of professional disciplines. (TR 1737-21)	RIPARIAN AND WETLAND CLASSIFICATION	http://www.blm.gov/nstc/library/pdf/1737-21.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Riparian	Community Typing/ Inventory	Ecological Site Inventory (ESI)	Site	Field Procedures for describing, and documenting ecological site information as it applies to the interaction between soils, climate, hydrology and vegetation for riparian-wetland resources and uplands.(TR 1737-7)	PROCEDURES FOR ECOLOGICAL SITE INVENTORY - WITH SPECIAL REFERENCE TO RIPARIAN-WETLAND SITES (TR 1737-7)	ftp://ftp.blm.gov/pub/nstc/techrefs/Final%20TR%201737-7.pdf
Riparian	Community Typing/ Inventory	Classification and Management of Riparian and Wetland sites in Montana" Pfister and Hansen	Site	Develop a riparian ecological site classification for Montana to assist in the identification, description, communication, and manageemt of riparian areas by resource managers. (TR 1737-5 page 17)	RIPARIAN AND WETLAND CLASSIFICATION REVIEW (TR 1737-5)	ftp://ftp.blm.gov/pub/nstc/techrefs/Final%20TR%201737-05.pdf
Riparian	Community Typing/ Inventory	Greenline or Alma H. Winward	Site	This procedure is designed to quantify the percent of each community type in a particular complex. These data may be used to indicate how much change has occurred in a particular complex (percent of acreage supporting altered community types), or how closely the composition of types in that area represents a previously described desired condition. Subsequent measurements in the same complex will provide information on the long-term trend of vegetation communities in that complex (TR 1737-8-2ed).	MONITORING THE VEGETATION RESOURCES IN RIPARIAN AREAS (TR 1737-8-2ed)	http://www.blm.gov/nstc/library/pdf/TR1737-8W.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Riparian	Composition	Current Vegetation Survey (CVS)		UNKNOWN		
Riparian	Composition	Photo plots		Photographs can be valuable sources of information in portraying resource values and conditions. Therefore pictures should be taken of all study areas. Use close-up and/or general view pictures with all of the study methods. Comparing pictures of the same site taken over a period of years furnishes visual evidence of vegetation and soil changes. In some situations, photo points could be the primary monitoring tool. All pictures should be in color, regardless of whether they are the primary or secondary monitoring tool (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Riparian	Composition	Vegetative Cross Section Composition		UNKNOWN--A cross section is completed as part of Winwards prtocol or as part of ESI.		
Riparian	Functioning Condition Assessment, Lentic	Proper Functioning Condition	Site	PFC is a qualitative method for assessing the conditoin of riparian wetland areas. The PFC assessment refers to a consistent approach for considering hydrology, vegetation, and erosion deposition (soils) attributes and processes to assess the condition of riparian wetland areas (TR 1737-11&16).	A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas (TR 1737-16)	http://www.blm.gov/nstc/library/pdf/Final%20TR%201737-11.pdf http://www.blm.gov/or/programs/nrst/files/Final%20TR%201737-16%20.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Riparian	Functioning Condition Assessment, Lotic	Proper Functioning Condition	Site	PFC is a qualitative method for assessing the conditoin of riparian wetland areas. The PFC assessment refers to a consistent approach for considering hydrology, vegetation, and erosion deposition (soils) attributes and processes to assess the condition of riparian wetland areas (TR 1737-9&15).	PROCESSESS FOR ASSESSING PROPER FUNCTIONOING CONDITION	http://www.blm.gov/nstc/library/pdf/Final%20TR%201737-9.pdf http://www.blm.gov/or/programs/nrst/files/Final%20TR%201737-15.pdf
Riparian	Several Parameters	Multiple Indicator Monitoring (MIM) by Cowley, Burton, & Smith			MONITORING STREAMBANKS AND RIPARIAN VEGETATION - MULTIPLE INDICATORS Idaho Tech Bulletin No 2007-01	http://www.blm.gov/id/st/en/info/publications/technical_bulletins/tb_07-01.html
Riparian	Several Parameters	PACFISH/ INFISH Biological Opinions (PIBO)		Developed in 1998 in response to monitoring needs addressed in the Biological Opinion for bull trout (USFWS 1998) and steelhead (NMFS 1995) (Kershner et al. 2004). The primary objective is to determine whether priority biological and physical attributes, processes, and functions of riparian and aquatic systems are being degraded, maintained, or restored in the PIBO area.		http://www.fs.fed.us/biology/fishecology/emp/ http://www.fs.fed.us/biology/resources/pubs/feu/2004_final_aremp_protocol.pdf

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Riparian	Trend Monitoring	Photo plots	Site	Observing physical and biological Change through Historical photographs. and Uses Fred Hall "ground based photographic monitoring " GTR PNW - GTR -503 May 2001 (TR 1737-13)	OBSERVING PHYSICAL AND BIOLOGICAL CHANGE THROUGH HISTORICAL PHOTOGRAPHS (TR 1737-13)	http://www.blm.gov/nstc/library/techref.htm
Riparian	Utilization	Various techniques.	Site	Setting a cage? Look to range---		
Soil or Soil Biota	Contaminant sampling and lab analysis					
Soil or Soil Biota	Erosion modeling	Measurement				
Soil or Soil Biota	Erosion modeling	Visual Observations				
Soil or Soil Biota	Slope Stability Analysis	Direct observation				
Soil or Soil Biota	Slope Stability Analysis	Modeling				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Soil or Soil Biota	Soil Aggregate Stability					
Soil or Soil Biota	Soil/water repellency (i.e. post-fire)					
Special Status Plants	Cover	Community Structure Analysis (CSA)				
Special Status Plants	Density	Community Structure Analysis (CSA)				
Special Status Plants	Frequency	?Other Measures of Frequency?				
Special Status Plants	Frequency	Community Structure Analysis (CSA)				
Special Status Plants	Population or site condition	Various techniques.				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Special Status Plants	Species presence	Complete population counts				
Special Status Plants	Species presence	Intuitive controlled inventory				
Special Status Plants		Photo plots only				
Water Quality or Quantity	Discharge	Gauges, weirs, stage measurements				
Water Quality or Quantity	Instream Flow Incremental Methodologies	PHABISM				
Water Quality or Quantity	Instream Flow Incremental Methodologies	RHABISM				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Water Quality or Quantity	Temperature	Continuous thermograph				
Water Quality or Quantity	Quality (temperature, sediment, water chemistry, other constituents, etc.).	Direct measurement				
Water Quality or Quantity	Sediment and other constituents	Light transmission				
Water Quality or Quantity	Sediment and other constituents	Sediment collection				
Animal Populations	Population monitoring	Direct count				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Animal Populations	Population monitoring	Simultaneous double count		This method is a form of mark-resight. Two observers in an aircraft independently observe and record groups of wild horses or wild burros. Sighting rates are estimated by comparing sighting records of the two observers. Groups seen by both observers must be identified.	ALTERNATIVE WILD HORSE AND BURRO SURVEY TECHNIQUES	http://www.fort.usgs.gov/WildHorsePopulations/AlternativeTech.asp
Animal Populations	Population monitoring	Mark resight		Mark-resight techniques use the number of marked animals that are observed or missed during a survey as the basis for estimating population size. Mark-resight techniques require that the population be closed.	ALTERNATIVE WILD HORSE AND BURRO SURVEY TECHNIQUES	http://www.fort.usgs.gov/WildHorsePopulations/AlternativeTech.asp
Animal Populations	Special Status aquatic species	Various techniques?????				
Animal Populations	Non-Special Status Aquatic species	Elecstoshocking				
Animal Populations	Non-Special Status Aquatic species	Netting				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Animal Populations	Non-Special Status Aquatic species	Seining				
Animal Populations	Non-Special Status Aquatic species	Macroinvertebrate collection				
Animal Populations	Non-Special Status Aquatic species	Plankton netting				
Animal Populations	Special Status terrestrial species (game and non-game)	Various techniques?????				
Animal Populations	Non-game terrestrial species (non-Special Status)	Various techniques?????				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Reg-ional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Animal Populations	Game terrestrial species (non-Special Status)	Various techniques??????				
Air Quality	Photographic methods					
Air Quality	Direct measure (PM-10,2.5	Gravimetric				
Climate	Precipitation	Gauges				
Climate	Weather????	RAWS weather stations				
Climate	Weather????	NOAA weather stations				
Lands or Minerals	Unreclaimed Surface Disturbance	Ocular Estimates				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Lands or Minerals	Unreclaimed Surface Disturbance	Line Intercept	Site	The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. Foliar and basal cover can be monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Lands or Minerals	Unreclaimed Surface Disturbance	Aerial Photos				
Lands or Minerals	Unreclaimed Surface Disturbance	Remote Sensing				
Lands or Minerals	Successful Reclamation - Interim and Final	Ocular Estimates				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Lands or Minerals	Successful Reclamation - Interim and Final	Line Intercept	Site	The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. Foliar and basal cover can be monitored with this method. It is important to establish a photo plot and take both close-up and general view photographs (TR 1734-4).	SAMPLING VEGETATION ATTRIBUTES (TR 1734-4)	http://www.blm.gov/nstc/library/pdf/samplveg.pdf
Lands or Minerals	Successful Reclamation - Interim and Final	Aerial Photos				
Lands or Minerals	Successful Reclamation - Interim and Final	Remote Sensing				
Recreation	Permitted recreation use	Direct measurement.				
Recreation	Permitted recreation use	Observation				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Recreation	Permitted recreation use	Photo Points				
Recreation	Permitted recreation use	Other				
Recreation	Casual recreation use	Direct measurement.				
Recreation	Casual recreation use	Observation				
Recreation	Casual recreation use	Photo Points				
Recreation	Casual recreation use	Other				
Recreation	Non-WSR Rivers	Direct measurement.				
Recreation	Non-WSR Rivers	Observation				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Recreation	Non-WSR Rivers	Other				
Recreation	Visitor numbers and demographics	Mechanical or Automated Counters				
Recreation	Visitor numbers and demographics	Registration/ Permits/ One-on-one Interviews				
Recreation	Visitor numbers and demographics	Formal Surveys				
Recreation	Visitor numbers and demographics	Personal Observations				
Recreation	Visitor numbers and demographics	Other				
Recreation	Visitor satisfaction, expectations and benefits	One-on-one Interviews				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Recreation	Visitor satisfaction, expectations and benefits	Formal Surveys				
Recreation	Visitor satisfaction, expectations and benefits	Comment Cards				
Recreation	Visitor satisfaction, expectations and benefits	Personal Observations				
Recreation	Recreation site condition	Assessments				
Recreation	Recreation site condition	Observation				
Recreation	Recreation site condition	Photo Points				
Recreation	Recreation site condition	Other				
Recreation	Visual resources (VRM)	Direct measurement.				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Recreation	Visual resources (VRM)	Observation				
Recreation	Visual resources (VRM)	Photo Points				
Recreation	Visual resources (VRM)	Other				
Recreation	Physical impacts	Direct measurement.				
Recreation	Physical impacts	Observation				
Recreation	Physical impacts	Other				
Travel & Transporta - tion	Visitor numbers and demographics	Mechanical or Automated Counters				
Travel & Transporta - tion	Visitor numbers and demographics	Registration/ Permits/ One-on-one Interviews				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Travel & Transporta - tion	Visitor numbers and demographics	Formal Surveys				
Travel & Transporta - tion	Visitor numbers and demographics	Personal Surveys				
Travel & Transporta - tion	Visitor numbers and demographics	Other				
Travel & Transporta - tion	Visitor satisfaction, expectations and benefits	One-on-one Interviews				
Travel & Transporta - tion	Visitor satisfaction, expectations and benefits	Formal Surveys				
Travel & Transporta - tion	Visitor satisfaction, expectations and benefits	Comment Cards				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Travel & Transporta - tion	Visitor satisfaction, expectations and benefits	Personal Observations				
Travel & Transporta - tion	Route inventory					
Travel & Transporta - tion	Route condition					
Travel & Transporta - tion	Noise (decibel)	Direct measurement.				
Travel & Transporta - tion	Recreation site condition	*Assessments*				
Travel & Transporta - tion	Recreation site condition	*Observation*				
Travel & Transporta - tion	Recreation site condition	Photo Points				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Travel & Transportation	Visual resources (VRM)	Direct measurement.				
Travel & Transportation	Visual resources (VRM)	Observation				
Travel & Transportation	Visual resources (VRM)	Photo Points				
Travel & Transportation	Visual resources (VRM)	Other				
Travel & Transportation	Recreation use or other physical impacts	Direct measurement.				
Travel & Transportation	Recreation use or other physical impacts	Observation				

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RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Travel & Transporta - tion	Recreation use or other physical impacts	Other				
Wilderness/ WSA, National Trails or Rivers	Requirements of enabling legislation	Various				
Wilderness/ WSA, National Trails or Rivers	Wilderness character	Various				
Wilderness/ WSA, National Trails or Rivers	Wild and Scenic River values	Various				

RESOURCE	ATTRIBUTE MEASURED	TECHNIQUE / PROTOCOL	SCALE (Local, Regional, National)	TECHNIQUE/PROTOCOL DESCRIPTION	HANDBOOK, TECH REF, PUBLICATION	WEB-BASED GUIDANCE
Wilderness/ WSA, National Trails or Rivers	National Historic or Scenic Trail characteristics	Interagency Trail Data Standards				
Wilderness/ WSA, National Trails or Rivers	National Historic or Scenic Trail characteristics	Various				
Wilderness/ WSA, National Trails or Rivers	Linear evaluation or assessment	Field Observations				
Wilderness/ WSA, National Trails or Rivers	Linear evaluation or assessment	Various				

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N: Evaluation of Assessment, Inventory, and Monitoring Related Training

Background: In collaboration with National Training Center this evaluation addresses BLM's national training program related to natural resource assessment, inventory, and monitoring. The NTC Renewable Resources & Planning Division was requested to review past and present AIM related training courses. These are courses with some degree of AIM-related, land health condition or trend instruction. Additionally, NTC managers and staff were encouraged to provide AIM training recommendations for the Local Workgroup's consideration.

Findings: The NTC provided the following courses that address monitoring with the three courses in bold teaching monitoring techniques.

1730-02: Designing Successful Forest and Woodland Projects

1730-05: Inventory and Monitoring of Plant Populations

1730-25: Aquatic Habitat Restoration and Enhancement

1730-35: Point Count Monitoring for Non-game Birds

1730-37: Interpreting Indicators of Rangeland Health

1730-41: Role of Microbiotic Crusts in Range Health

1730-60: Restoration of Sage Brush Ecosystems

4700-07: Wild Horse and Burro Herd Management

As of the date of this paper, there were no new courses being designed to teach monitoring methodologies. There is, however, a pending wildlife and fisheries training needs analysis planned for this fiscal year.

Another important finding is the importance of the NTC's competency data base. This information is an exhaustive effort to identify BLM's business processes and required competencies. The data base is accessible through a LOTUS NOTES link that either the Training Center or Dan Muller can provide. An example of one competency assessment, Monitoring and Evaluation – Monitor Grazing Allotments, is displayed on the following page. In consultation with the NTC, the next step for the Competency analyses is to perform a Gap Analysis that deals with existing skills and training needs for BLM. The WO program offices are responsible to initiate a Gap Analysis.

At the end of this report, you will find an exhaustive list of courses. These courses address a broader array of training coordinated by NTC that relate to assessment, inventory, and monitoring.

Recommendations: There are three recommendations that may be derived from the preceding findings. The following briefly lists these recommendations:

1. Gap Analyses - complete a Gap Analysis for effectiveness-related monitoring of LUP, activity and treatment implementation
2. Training Needs – combine Gap Analysis results with other tools to determine BLM training needs
3. AIM Training – design and conduct a BLM training course related to integrating planning and monitoring

NTC Competency Evaluation Example

Competency Family:	**Monitoring & Evaluation**
Competency Name:	**Monitor Grazing Allotments**
Competency Description:	**Collects and analyzes data on the effectiveness of management practices, restoration measures or project/treatments in achieving and/or measuring movement toward land use objectives and/or rangeland health standards; utilizes any form of reoccurring data that will assist in characterizing allotments such as vegetation production, utilization, use pattern mapping and actual use.**
Competency Levels:	
Entry:	**Performed under close supervision or in close collaboration with a more experienced BLM colleague.**
Journey:	**Seasoned employee. Performs the more difficult tasks. Has received advanced training. Straightforward tasks are performed with minimal supervision. More complex tasks require close supervision or team work with a more experienced BLM colleague.**
Expert:	**Requires little or no supervision for complex policy, program, and technical issues at the local, state, and national levels. Are innovators of new approaches to complex issues. Serve as mentors and technical reviewers/advisors for Working and Journey level employees in the program.**
Competency Type:	
Behavioral:	**Are the competencies that are designed to recognize and incorporate the critical value that attributes (e.g., attitudes, interpersonal skills, communication, etc.) to excellent job performance**
Common to all:	**Are the competencies people from entry level to SES, in all roles and functions, use to accomplish work skills, areas of knowledge, and attributes. The basic competencies also serve as the building blocks that form the foundation for higher level competencies which become critical as an individual advances in DOI and assumes positions with increased responsibility and authority.**
Technical/Functional:	**Are the specialized skills, knowledge, and attributes needed for success within a business function/occupational group. The competencies focus on what an individual needs to perform the current and future work**

Training Closely Related to AIM-Activities in the DOI Catalogue

Assessment:

-Interagency Consultation for Endangered Species – biological assessment S. 7 ESA
-NEPA Analysis – environmental assessments
-Natural Resource Damage Assessment & Restoration – multidisciplinary NRDAR team
-GIS Vegetative Cover Mapping – National Vegetation Classification System mapping
-Stream Habitat Measurement Techniques – habitat characteristics assessment
-Land Environmental Site Assessment-Level I Procedures – contaminants & hazards
-Endangered Species Listing & Candidate Assessment – USFWS procedures
-Cumulative Effects Assessment – identification, mitigation, monitoring CE's
-Ecological Risk Assessment – related to insecticides, fungicides, etc.
-Coldwater Fish Culture – fish physiology and health determinations
-Advanced Fisheries Management – common inland fisheries sampling
-River Assessment and Monitoring – verification and time trend analyses
-Developing a Biological Assessment – conducting BA training
-Environmental Regulatory Compliance Audits – first voluntary audit standard

Inventory:

-Non-Game Wildlife Survey Techniques – amphibian, reptile, etc. inventory

Monitoring:

-Aquatic Macroinvertebrate Sampling – monitoring tool
-GIS Use for Wildlife Habitat Management – modeling, monitoring, analysis applications
-Survey & Habitat Monitoring for Nongame Birds – species and habitat techniques
-Advanced Macroinvertebrate Ecology & Identification – habitat and organism related
-Habitat Management Planning – includes aspects of monitoring adaptive management
-Principles of Integrated Pest Management – fundamentals
-Characterization of Abandoned Mine Lands – mine site characterization & reclamation
-Wildlife Disease Monitoring Procedures – avian and mammalian diseases
-Introduction to Conservation Biology – includes habitat fragmentation
-Amphibian Health Exams & Disease Monitoring – health assessment
-Reclamation – operational aspects of dirtwork and reclamation; field inspections
-Invasive Plant Management – identifying characteristics & landscape impacts
-Rotenone & Antimycin Use in Fish Management – fish sampling and control

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O: Terms Related to Assessment, Inventory, and Monitoring

Abundance: The total number of individuals of a species in an area, population, or community (SRM 1999).

Accelerated erosion: Erosion in excess of natural rates, usually as a result of anthropogenic activities (SSSA 1997).

Adaptive Management: a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form-"active" adaptive management-employs management programs that are designed to experimentally compare selected policies or practices, by implementing management actions explicitly designed to generate information useful for evaluating alternative hypotheses about the system being managed. (NPS I&M website Glossary)

Age classes: The distribution of different ages of the same species or group of species on a site (IIRH, Version 4).

Age Class: A descriptive term to indicate the relative age of plants (Habich, 2001).

Air-dry weight: The weight of vegetation after it has been allowed to dry to equilibrium with the atmosphere (Habich, 2001).

Air Quality: the quality of the atmosphere as determined by the concentration of air pollutants, visibility, odors, sound, and other energy forms transmitted through the atmosphere.

Air Quality Related Attributes: those attributes of a PSD Class II area (designated by Congress such as wilderness or wild and scenic rivers) important to the purpose for which the area was established, which may be affected by air pollution. Air quality related attributes include, but are not limited to, visibility, flora, fauna, ecologic, geologic, historic, and cultural characteristics.

Air Quality Related Values (AQRVs): those values of a PSD Class I area important to the purpose for which the area was established, which may be affected by air pollution. Air Quality Related Values include, but are not limited to, visibility, flora, fauna, ecologic, geologic, historic, and cultural characteristics.

Air resource: the air or atmospheric component of the ecosystem. As a management activity, the air resource includes the consideration of climate, weather, air quality, and air quality related attributes and values.

Allotment: an area of land designated and managed for grazing by livestock. Such an area may include intermingled private, State, or Federal lands used for grazing in conjunction with the public lands (Habich, 2001).

Annual plant: A plant that completes its life cycle and dies in 1 year or less (SRM 1999).

Annual production: The net quantity of aboveground vascular plant material produced within a year. *Synonym:* net aboveground primary production (IIRH, Version 4).

*OR…*The conversion of solar energy to chemical energy through the process of photosynthesis. It is represented by the total quantity of organic material produced within a given period of time (Habich, 2001).

Assessment: The process of estimating or judging the value or functional status of ecological processes (e.g., rangeland health) in a location at a moment in time (IIRH, Version 4).

*OR…*The process of estimating or judging the functional status of ecosystem structures, functions, or processes within a specified geographic area at a specific time (USDI 2001…H-4180-1-Rangeland Health Standards).

At risk: Rangelands that have a reversible loss in productive capability and increased vulnerability to irreversible degradation based upon an evaluation of current conditions of the soil and ecological processes (NRC 1994). At risk designation may point out the need for additional information needed to better quantify the functional status of an attribute (IIRH, Version 4).

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Attribute: One of the three components, soil/site stability, hydrologic function, and biotic integrity that collectively define rangeland health (IIRH, Version 4).

*OR…*one of the three components—soil and site stability, hydrologic function, and integrity of the biotic community—that collectively define rangeland health (Herrick et al. 2005, Interagency Tech Ref 1734-6 2000).

OR…..a distinctive feature of an object (EPA Terminology Reference System… from onelook.com)

OR……an inherent characteristic (Merriam-Webster Online)

OR… any living or nonliving feature or process of the environment that can be measured or estimated and that provide insights into the state of the ecosystem. The term **Indicator** is reserved for a subset of attributes that is particularly information-rich in the sense that their values are somehow indicative of the quality, health, or integrity of the larger ecological system to which they belong (Noon 2003). See Indicator. (NPS, I&M website Glossary)

Autogenic: Self-restoring (SER, 2002).

Badland: A land type consisting of steep or very steep barren land, usually broken by an intricate maze of narrow ravines, sharp crests, and pinnacles resulting from serious erosion of soft geologic materials (SRM 1999).

Bare ground: All land surface not covered by vegetation, rock, or litter (Habich, 2001).

OR… All land surface not covered by vegetation, rock, or litter (SRM 1999). As used in this document, visible biological crusts and standing dead vegetation are included in cover estimates or measurements and therefore are **not** bare ground (e.g., mineral soil) (IIRH, Version 4).

Basal area (plants): The cross-sectional area of the stem or stems of a plant or of all plants in a stand. Herbaceous and small woody plants are measured at or near the ground level; larger woody plants are measured at breast or other designated height. *Synonym:* basal cover (SRM 1999).

Basal cover (area): the cross-sectional area of the stem or stems of a plant or all plants in a stand. Herbaceous and small woody plants are measured at or near ground level; larger woody plants are measured at breast or other designated height (Habich, 2001).

Basal cover (plants): The percent of soil surface covered by plant bases. *Synonym:* basal area (SRM 1999).

Biodiversity: refers to biota in terms of taxonomic and genetic diversity, the variety of life forms present and the community structure thereby created, and the ecological roles performed (SER, 2002).

Biological crust: Microorganisms (e.g., lichens, algae, cyanobacteria, microfungi) and non-vascular plants (e.g., mosses, lichens) that grow on or just below the soil surface. *Synonym:* microbiotic crust and cryptogamic crust (IIRH, Version 4).

Biomass: The total amount of living plants and animals above and below ground in an area at a given time (Habich, 2001).

Biomass (plants): The total amount of living plants above and below ground in an area at a given time (SRM 1999). As used in this document, biomass refers only to parts of standing living plants above ground, and not the roots (IIRH, Version 4).

Biotic integrity: Capacity of a site to support characteristic functional and structural communities in the context of normal variability, to resist loss of this function and structure due to a disturbance, and to recover following such disturbance. (One of the three attributes of rangeland health.) (IIRH, Version 4).

Blowout: An excavation in areas of loose soil, usually sand, produced by wind; a breakthrough or rupture of a soil surface attributable to hydraulic pressure, usually associated with sand boils (SRM 1999).

Brush: A term encompassing various species of shrubs or small trees usually considered undesirable for livestock or timber management. The same species may have value for browse, wildlife habitat, or watershed protection (Habich, 2001).

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Bunch grass: A grass having the characteristic growth habit of forming a bunch; lacking stolens or rhizomes (Habich, 2001).

Canopy Cover: the proportion of the soil surface covered by a vertical projection of a plant canopy; the area that is protected from raindrops and is in the shade when the sun is directly overhead

*OR…*the percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included. Canopy cover may exceed 100 percent and is synonymous with crown cover (Habich, 2001).

Cartographic Scale: The relationship between a map and real world objects (e.g., 1:100,000).

Chemical soil crust: A soil-surface layer, ranging in thickness from a few millimeters to a few centimeters, that is formed when chemical compounds become concentrated on the soil surface. They can reduce infiltration and increase overland water flow similar to physical crusts. They are usually identified by a white color on the soil surface (IIRH, Version 4).

Class I Area: an area designated under the Prevention of Significant Deterioration program with the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each national park over 6,000 acres and each wilderness area over 5,000 acres as of August 7, 1977.

Class II Area: an area designated under the Prevention of Significant Deterioration program with a moderate degree of protection from future degradation of air quality.

Climate: composite or generalized weather conditions of a specific region, such as temperature, pressure, humidity, precipitation, sunshine, cloudiness, and winds, averaged over a series of years.

Climax plant community (climax): The final or stable biotic community in a successional series; it is self-perpetuating and in equilibrium with the physical habitat (SRM 1999).

Community pathway: Shifts in plant species compositions among biological communities within a single state (IIRH, Version 4).

Community structure: the physiognomy or architecture of the community with respect to the density, horizontal stratification, and frequency distribution of species-populations, and the sizes and life forms of the organisms that comprise those communities (SER, 2002).

Compaction layer: A near surface layer of dense soil caused by the repeated impact on or disturbance of the soil surface. When soil is compacted, soil grains are rearranged to decrease the void space and bring them into closer contact with one another, thereby increasing the bulk density (SSSA 1997).

Compliance Monitoring –

Composition: The proportions of various plant species in relation to the total on a given area; it may be expressed in terms of cover, density, weight, etc. *Synonym:* Species composition (SRM 1999).

Conceptual Models: purposeful representations of reality that provide a mental picture of how something works to communicate that explanation to others. (NPS I&M website glossary)

Cool season plants: Plants whose major growth occurs during the late fall, winter, and spring. Cool season species generally exhibit C3 photosynthetic pathways (Habich, 2001).

Cover: the proportion of the soil surface covered by a vertical projection of the cover class of interest (e.g. canopy cover, basal cover, litter cover), regardless of what is above or below the object (Herrick et al. 2005).

OR…an indication of the relative amount of shelter or protection of all vegetation at a given point, normally used to assess nesting habitat (Connelly, Reese, and Schroeder 2003).

OR… Percentage of material, other than bare ground, covering the land surface. It may include live and standing dead vegetation, litter, biological crust, cobble, gravel, stones, and bedrock. Ground cover plus bare ground would total 100 percent. *Synonym:* ground cover. (IIRH, Version 4).

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Criteria Pollutants: air pollutants for which national ambient air quality standards have been set. These include carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone and sulfur oxides.

Cultural landscape (or ecosystem): one that has developed under the joint influence of natural processes and human-imposed organization (SER, 2002).

Damage: acute and obvious changes in an ecosystem (SER, 2002).

Decomposition: The biochemical breakdown of organic matter into its original compounds and nutrients (IIRH, Version 4).

Degradation: subtle or gradual changes that reduce ecological integrity and health (SER, 2002).

Deposition area: An area offsite from where the original soil erosion occurred that now has the soil deposits from the original soil erosion area (IIRH, Version 4).

Descriptor: The narrative that describes the indicator characteristics under each of the five rating categories (Extreme to Total, Moderate to Extreme, Moderate, Slight to Moderate, and None to Slight) in the Rangeland Health Indicator Evaluation Matrix. The "default descriptor" is printed in the Matrix, while the "revised descriptor" is completed by the evaluators if the default descriptor does not fit the characteristics of a particular indicator for a particular ecological site (IIRH, Version 4).

Desired plant community: Of the several plant communities that may occupy a site, it is the one that has been identified through a management plan to best meet the plan's objectives for the site. It must protect the site at a minimum (Habich, 2001).

Destroyed: when degradation or damage removes all macroscopic life and commonly ruins the physical environment of an ecosystem (SER 2002).

Dominant species: Plant species or species groups, which by means of their number, coverage, or size, have considerable influence or control upon the conditions or existence of associated species (Habich, 2001).

OR… Plant species or species groups, which by means of their number, coverage, or size, have considerable influence or control upon the conditions of existence of associated species (SRM 1999). Daubenmire (1968) defines dominant species as "those species whose removal would bring about the greatest readjustments in the edaphic, aerial, and biotic character of their ecosystem. They are often the tallest plants" and "where there is little difference in size, dominance is determined primarily by numbers of individuals." For purposes of this document, *Interpreting Indicators of Rangeland Health*, dominant plants are those of the greatest size per unit area as measured by biomass, production, or cover (IIRH, Version 4).

Driver: The major external driving forces that have large-scale influences on natural systems. Drivers can be natural forces or anthropogenic. (NPS I&M website glossary)

Ecological engineering: manipulation of natural materials, living organisms and the physical-chemical environment to achieve specific human goals and solve technical problems (SER, 2002).

Ecological integrity: a concept that expresses the degree to which the physical, chemical, and biological components (including composition, structure, and process) of an ecosystem and their relationships are present, functioning, and capable of self-renewal. Ecological integrity implies the presence of appropriate species, populations and communities and the occurrence of ecological processes at appropriate rates and scales as well as the environmental conditions that support these taxa and processes. (NPS I&M website glossary)

Ecological process: Natural processes that function within a normal range of variation to produce and support specific plant and animal communities. Ecological processes include: water cycle (the capture storage and redistribution of precipitation); energy flow (conversion of sunlight to plant and animal matter); and nutrient cycle (the cycle of nutrients such as nitrogen and phosphorus through the physical and biotic components of the environment) (Habich, 2001).

OR… the dynamic attributes of ecosystems, including interactions among organisms and interactions between organisms and their environment. Ecological processes are the basis for self-maintenance in an ecosystem (SER, 2002).

Ecological Reference Area (ERA): land in which ecological processes are functioning within a normal range of variability and the plant community has adequate resistance to and resiliency from most disturbances. This area best represents the potential of a site in both physical function and biological health (Herrick et al. 2005).

OR… An area representing a single ecological site in which ecological processes are functioning within a normal range of variability and the plant community has adequate resistance to and resistance from most disturbances. These areas do not need to be pristine, historically unused lands (e.g., climax plant communities or relict areas) (IIRH, Version 4).

Ecological restoration: the practice of restoring ecosystems as performed by practitioners at specific project sites, based upon restoration ecology science (SER, 2002).

Ecological scale: The spatial or temporal dimensions of phenomena, or, e.g., land management projects (treatments, use authorizations).

Ecological site: A kind of land with a specific potential natural community and specific physical site characteristics, differing from other kinds of land in their ability to produce distinctive kinds and amounts of vegetation and to respond to management. Ecological sites are defined and described with information about soil, species composition, and annual production (Habich, 2001).

Ecological site description: A written narrative of the description of soils, climate, vegetation, uses, and potential of a kind of land with specific physical characteristics to produce distinctive kinds and amounts of vegetation (Habich, 2001).

OR… Description of the soils, uses, and potential of a kind of land with specific physical characteristics to produce distinctive kinds and amounts of vegetation (IIRH, Version 4).

Ecological site inventory: A resource inventory that involves the use of soils information to map ecological sites and plant communities and the collection of natural resource and vegetation attributes. The sampling data from each of these soil-vegetation units, referred to as site write-up areas (SWAs), become the baseline data for natural resource management and planning (Habich, 2001).

Ecological trajectory: one that describes the developmental pathway of an ecosystem through time. In restoration, the trajectory begins with the unrestored ecosystem and progresses towards the desired state of recovery that is expressed in the goals of a restoration project and embodied in the reference ecosystem (SER, 2002).

Ecosystem: defined as, "a spatially explicit unit of the Earth that includes all of the organisms, along with all components of the abiotic environment within its boundaries" (Likens 1992). (NPS I&M website glossary)

*OR…*Organisms together with their abiotic environment forming an interacting system and inhabiting an identifiable space (Habich, 2001).

*OR…*Consists of the biota (plants, animals, microorganisms) within a given area, the environment that sustains it, and their interactions (SER, 2002).

Ecosystem drivers: major external driving forces such as climate, fire cycles, biological invasions, hydrologic cycles, and natural disturbance events (e.g., earthquakes, droughts, floods) that have large scale influences on natural systems. (NPS I&M website glossary)

Ecosystem health: the state or condition of an ecosystem in which its dynamic attributes are expressed within 'normal' ranges of activity relative to its ecological stage of development. A restored ecosystem expresses health if it functions normally relative to its reference (ecosystem), or to an appropriate set of restored ecosystem attributes (SER, 2002).

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Ecosystem integrity: the state or condition of an ecosystem that displays the biodiversity characteristic of the reference (ecosystem), such as species composition and community structure, and is fully capable of sustaining normal ecosystem functioning (SER, 2002).

Ecosystem management: the process of land-use decision making and land-management practice that takes into account the full suite of organisms and processes that characterize and comprise the ecosystem. It is based on the best understanding currently available as to how the ecosystem works. Ecosystem management includes a primary goal to sustain ecosystem structure and function, a recognition that ecosystems are spatially and temporally dynamic, and acceptance of the dictum that ecosystem function depends on ecosystem structure and diversity. The whole-system focus of ecosystem management implies coordinated land-use decisions. (NPS I&M website glossary)

Effectiveness Monitoring: the process of collecting data and information in order to determine whether or not desired outcomes (expressed as goals and objectives in the land use plan) are being met (or progress is being made towards meeting them) as the allowable uses and management actions are being implemented. A monitoring strategy must be developed as part of the land use plan that identifies indicators of change, acceptable thresholds, methodologies, protocols, and timeframes that will be used to evaluate and determine whether or not desired outcomes are being achieved (BLM H-1601-1, 2005).

Ecosystem stability: the ability of an ecosystem to maintain its given trajectory in spite of stress; it denotes dynamic equilibrium rather than stasis. Stability is achieved in part on the basis of an ecosystem's capacity for resistance and resilience (SER, 2002).

Emissions Inventory: a quantitative statement of the types and quantities of air pollutants emitted for specified source categories within a specified place or region over a specified period of time. For any pollutant, emissions usually are expressed in terms of the tons per day, pounds per hour, or grams per second.

Energy flow: Conversion of sunlight to plant and animal matter; one of the ecological processes (IIRH, Version 4).

Erosion: Detachment and movement of soil or rock fragments by water, wind, ice, or gravity (Habich, 2001).

OR... Detachment and movement of soil or rock fragments by water, wind, ice, gravity; the land surface worn away by running water, wind, ice, or other geological agents, including such processes as gravitational creep (SRM, 1999).

Evaluation area: The area (generally ½ to 1 acre in size) where the evaluation of rangeland health attributes takes place (IIRH, Version 4).

Evaluator(s): The person or persons conducting the evaluation of rangeland health on an evaluation area (IIRH, Version 4).

Exclosure: An area fenced to exclude animals (SRM, 1999).

Exotic plant: A plant growing on or occurring in an ecosystem beyond its natural range of existence or natural zone of potential dispersal (IIRH, Version 4).

Fauna: The animal species of a region (Habich, 2001).

Flow pattern: The path that water takes (i.e., accumulates) as it moves across the soil surface during overland flow (IIRH, Version 4).

Foliar Cover: The percentage of ground covered by the vertical projection of the aerial portion of plants. Small openings in the canopy and intraspecific overlap are excluded. Foliar cover is always less than canopy cover; either may exceed 100 percent (USDA, 1997).

Forb: an herbaceous plant other than a grass, sedge, or other plant with similar foliage (Connelly, Reese, and Schroeder 2003).

*OR…*Any herbaceous plant other than those in the Gramineae (true grasses), Cyperaceae

(sedges), and Juncaceae (rushes) families (i.e., any nongrass-like plant) having little or no woody material on it; a broadleafed flowering plant whose above ground stem does not become woody and persistent (Habich, 2001).

OR…a broad-leaved herb other than a grass, especially one growing in a field, prairie, or meadow.

Forestland: Land on which the potential natural community is dominated by trees (Habich, 2003).

Functional/structural groups: A suite or group of species that because of similar shoot or root structure, photosynthetic pathways, nitrogen fixing ability, life cycle, etc., are grouped together on an ecological site basis (IIRH, Version 4).

*OR…*assemblages of organisms by their functional roles in the ecosystem (e.g., primary producers, herbivores, carnivores, decomposers, nitrogen fixers, pollinators) (SER, 2002).

Functioning: (1) Refers to the rangeland health attributes where the majority (see definition of "preponderance of evidence") of the associated indicators are rated as having little or no deviation from that described in the Reference Sheet (Appendix 2) for the ecological site; (2) Refers to the presence and integrity of ecological processes (energy flow, water cycling, and nutrient cycling) being within the range of expectations for the ecological site (IIRH, Version 4).

Genetic fitness: the gene pool possesses genetic redundancy, whereby the gene pool contains a diversity of alleles that may be selected in response to environmental change (SER, 2002).

Geomorphology: The science that studies the evolution of the earth's surface. The science of landforms (SSSA 1997).

Grass: Any plant of the family Gramineae (Poaceae) (Habich, 2001).

Grasslike plant: A plant of the Cyperaceae (sedges) and Juncaceae (rushes) families, which vegetatively resembles a true grass of the Gramineae family (Habich, 2001).

Ground cover: The percentage of material, other than bare ground, covering the land surface. It may include live and standing dead vegetation, litter, cobble, gravel, stones, and bedrock. Ground cover plus bare ground would total 100 percent (Habich, 2001).

Growing season: That portion of the year when temperatures and moisture permit plant growth. In tropical climates, it is determined by the availability of moisture (Habich, 2001).

Gully: A furrow, channel, or miniature valley, usually with steep sides, through which water commonly flows during and immediately after rains or snow melt (Habich, 2001).

OR… Small channels eroded by concentrated water flow (IIRH, Version 4).

Habitat: an area with the combination of resources (like food, shelter and water) and environmental conditions (like temperature, precipitation) that promotes occupancy by individuals of a given species (or population) and allows those individuals to survive and reproduce. The definition of habitat is specific to the organism or species of interest. It can be more than a single vegetation type or vegetation structure, and is the sum of the specific resources needed by a species (e.g., food, shelter, water).

OR…a place where an animal or plant normally lives for a substantial part of its life, often characterized by dominant plant forms and/or physical characteristics (BLM Manual 6600-Fish, Wildlife, and Special Status Plant Resources Inventory and Monitoring 1990)

*OR…*the dwelling place of an organism or community that provides the requisite conditions for its life processes (SER 2002).

Habitat Fragmentation: The mixture of habitat and non-habitat (synonymous with unsuitable habitat). The process of habitat fragmentation is one where a species habitat is being reduced (habitat loss) and fragmented into pieces separated by areas of unsuitable habitat. Habitat fragmentation has not occurred when habitat has been separated by unsuitable habitat but occupancy, reproduction or survival of the species has not been affected (Franklin et al. 2002).

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OR…..Habitat fragmentation is the disruption of extensive habitats into isolated and small patches, often resulting in loss of total habitat area and the creation of smaller, more isolated, remaining habitat patches (Meffe and Carroll 1997).

OR…..The breaking up of large and continuous ecosystems, communities, and habitats into smaller areas that are surrounded by altered or disturbed land or aquatic substrate (EPA Terminology Reference System)

Habitat Generalist: an organism which can survive under a wide variety of conditions, and does not specialize to live under any particular set of circumstances (UCMP Ecology Glossary, onelook.com)

Habitat Indicator: Component or attribute of habitat that can be observed and/or measured that provides evidence of habitat suitability.

Habitat Patch: A species habitat unit, appropriate for the scale of interest, surrounded by unsuitable habitat (adapted from Franklin et al. 2002).

OR…..A habitat unit of variable size that contains a homogenous set of characteristics (Connelly, Reese, and Schroeder 2003).

Habitat Suitability: the relative appropriateness of a certain ecological area for meeting the life requirements of an organism.

> ***Suitable Habitat:*** habitats, described by the availability, condition, and proximity of life requisites on the landscape; that provide conditions necessary for successful survival and reproduction when compared to similar environments (Cooperrider et al. 1986, Morrison et al. 1998).
>
> ***Marginal Habitat:*** Habitats that support the species but survival rates and reproduction are generally lower than that for suitable habitats by comparison (Cooperrider et al. 1986).
>
> ***Unsuitable Habitat:*** Ecological area is missing one or more of the basic habitat requirements of food, shelter or water and therefore, cannot support sustainable populations. *(Note: Connelly et al. (2004) considered urban, agriculture, water, and forested habitats to be unsuitable habitats for greater sage-grouse. Grasslands were included in potential habitat only if located < 5 km from a sage-grouse lek that was active within the past 10 years. Otherwise grasslands were classed as nonhabitat or unsuitable (page 5-15).)*

Half-shrub: A perennial plant with a woody base whose annually produced stems die each year (SRM 1999).

Harvest: The removal of annual vegetation production from an area of land (Habich, 2001).

Headcut: Abrupt elevation drops in the channel of a gully that accelerate erosion as it undercuts the gully floor and migrates upstream (IIRH, Version 4).

Healthy rangelands: The degree to which the integrity of the soil, vegetation, water, and air, as well as the ecological processes of the rangeland ecosystem, are balanced and sustained. Integrity is defined as maintenance of the structure and functional attributes characteristic of a locale, including normal variability (SRM 1999). *Synonym:* rangeland health.

Herbaceous: Nonwoody plant growth (Habich, 2001).

Historical climax plant community: The plant community considered to best typify the potential plant community of an ecological site prior to the advent of European man (Habich, 2001).

OR… The plant community that was best adapted to the unique combination of factors associated with the ecological site. It was in a natural dynamic equilibrium with the historic biotic, abiotic, climatic factors on its ecological site in North America at the time of European immigration and settlement (USDA 1997).

Historical Reference Point: an ecological site where data were collected to be used as a basis or standard for evaluation or comparison over time.

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Hydrologic function: The capacity of the site to capture, store, and safely release water from rainfall, run-on, and snowmelt (where relevant), to resist a reduction in this capacity, and to recover this capacity following degradation (one of the three attributes of rangeland health). (IIRH, Version 4).

Increaser: For a given plant community, those species that increase in amount as a result of a specific abiotic/biotic influence or management practice (SRM 1999).

Indicator: Components of a system whose characteristics (e.g., presence or absence, quantity, distribution) are used as an index of an attribute (e.g., rangeland health) that are too difficult, inconvenient, or expensive to measure (IIRH, Version 4).

Implementation Monitoring: the process of tracking and documenting the implementation (or progress toward implementation) of land use plan decisions. This should be done at least annually and should be documented in the form of a tracking log or report. The report must be made available for public review. The report should describe management actions proposed or undertaken to implement land use plan decisions and can form the basis for annual budget documents. In subsequent years, reports should document which management actions were completed and what further actions are needed to continue implementing land use plan decisions. (BLM H-1601-1, 2005).

Increaser: Those species that increase in amount for a given plant community, as a result of a specific abiotic/biotic influence or management practice (Habich, 2001).

Increments: the amount of additional pollution, above a specified baseline level, which may be allowed in a particular PSD (Prevention of Significant Deterioration) area. The amount of allowable increment varies with whether the area is Class I, Class II, or Class III.

Indicator: Component of a system whose characteristics (e.g. presence or absence, quantity, distribution) are used as an index of an attribute (Interagency Tech Ref 1734-8 2000).

*OR…*a subset of monitoring attributes that are particularly information-rich in the sense that their values are somehow indicative of the quality, health, or integrity of the larger ecological system to which they belong (Noon 2003). Indicators are a selected subset of the physical, chemical, and biological elements and processes of natural systems that are selected to represent the overall health or condition of the system. (NPS I&M website glossary)

Infiltration: The entry of water into the soil (SSSA 1997).

Influential scientific information: Under the Data Quality Act, scientific information the agency reasonably can determine will have or does have a clear and substantial impact on important public policies or private sector decisions.

Interrill erosion: The removal of a fairly uniform layer of soil on a multitude of relatively small areas by splash due to raindrop impact and by sheet flow (SSSA 1997).
Invader: Plant species that were absent in undisturbed portions of the original vegetation of a specific range site and will invade or increase following disturbance or continued heavy grazing (SRM 1999).

Invasion: The migration of organisms from one area to another area and their establishment in the latter (Habich, 2001).

Invasive plants: Plants that are not part of (if exotic), or are a minor component of (if native), the original plant community or communities that have the potential to become a dominant or co-dominant species on the site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g. short-term response to drought or wildfire) are not invasive plants (IIRH, Version 4).

Inventory: the systematic acquisition and analysis of resource information needed for planning and management purposes (Interagency Tech Reference 1734-6 2000).

OR…Gathering of baseline information (including quantitative data, cultural knowledge, and qualitative observations) about condition of resources (BLM H4180-1-Rangeland Health Standards 2001).

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*OR…*the periodic and systematic collection and analysis of data on the distribution, condition, trend, and utilization of fish and wildlife resources and special status plant species (BLM Manual 6600-Fish, Wildlife, and Special Status Plant Resources Inventory and Monitoring 1990).

*OR…*An extensive point-in-time survey to determine the presence/absence, location or condition of a biotic or abiotic resource. (NPS I&M website glossary)

Land Use Plan: Land use plans means a resource management plan (RMP) or management framework plan (MFP), developed under the provisions of 43 CFR 1600. These plans are developed through public participation in accordance with the provisions of the Federal Land Policy and Management Act of 1976 and establish management direction for resource uses of public lands (43 CFR 4100).

Landscape: consists of a mosaic of two or more ecosystems that exchange organisms, energy, water, and nutrients (SER, 2002).

Life Form: Characteristic form or appearance of a species at maturity, such as a grass, forb, tree, or shrub (Habich, 2001).

Life Requisites: items an animal needs to survive; these include food, shelter / cover, and water. (Morrison et al. 1998)

Litter: The uppermost layer of organic debris on the soil surface; essentially the freshly fallen or slightly decomposed vegetal material (Habich, 2001).

Maintenance Area: a geographic area in which the concentration of one or more criteria pollutants once exceeded national ambient air quality standards, but is currently subject to a formal plan to prevent future violations.

Major land resource area: Broad geographic areas that are characterized by a particular pattern of soils, climate, water resources, vegetation, and land use. Each MLRA, in which rangeland and forestland occur, is further divided into ecological sites (Habich, 2001).

Management objective: A planned result to be achieved within a stated time period. Objectives are subordinate to goals, are specific with shorter timeframes, and have increased possibility of attainment. Time periods for completion and outputs or achievements are measurable and quantifiable (Habich, 2001).

Marginal Habitats: see definition under habitat suitability.

Measures: specific feature(s) used to quantify an indicator, as specified in a sampling protocol. For example, pH, temperature, dissolved oxygen, and specific conductivity are all measures of water chemistry. (NPS I&M website glossary)

Metadata: Data about data. Metadata describes the content, quality, condition, and other characteristics of data. Its purpose is to help organize and maintain a organization's internal investment in spatial data, provide information about an organization's data holdings to data catalogues, clearinghouses, and brokerages, and provide information to process and interpret data received through a transfer from an external source. (NPS I&M website glossary)

Microsite: A spatial unit that contains only a few biological individuals that has a distinct climate or soil from the surrounding units (e.g., the spaces between plants relative to the spaces under plants). (IIRH, Version 4).

Mitigation: an action that is intended to compensate environmental damage (SER, 2002).

Monitoring: The regular collection of data over time to evaluate: 1) whether objectives or land health standards are being achieved; 2) effectiveness of management actions (BLM H-4180-1-Rangeland Health Standards 2001).

OR… the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective (Elzinga, Salzer, and Willoughby 1998).

OR… the orderly collection and analysis of resource data to evaluate progress in meeting resource management objectives. Monitoring may also include 1) the collection of data to evaluate progress in complying with laws, regulations, policies, executive orders, and management decisions, and 2) the

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collection of data in order to assist in resource protection (BLM Manual 6600-Fish, Wildlife, and Special Status Plant Resources Inventory and Monitoring 1990)

OR… The orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives. The process must be conducted over time in order to determine whether or not management objectives are being met (SRM 1999).

National Ambient Air Quality Standards (NAAQS): the allowable concentrations of air pollutants in the ambient (public outdoor) air specified in 40 CFR 50. National ambient air quality standards are based on the air quality criteria and divided into primary standards (allowing an adequate margin of safety to protect the public health) and secondary standards (allowing an adequate margin of safety to protect the public welfare). Welfare is defined as including (but not limited to) effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, climate, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being.

Native invasive: A native plant that has migrated to a site where it was not a part of the original plant community, or a native plant that because of management or other changes is now increasing beyond its original composition on the site (IIRH, Version 4).

Native pasture: Land on which native vegetation (climax or natural potential plant community) is forest, but which is used and managed primarily for production of native plants for forage. Native pasture includes cutover forestland and forested areas that were cleared and used as cropland (Habich, 2001).

Native species: A species that is a part of the original fauna and flora of an area (Habich, 2001).

Natural Background Level: the concentration of a pollutant that would exist in the absence of anthropogenic (human-caused) pollution.

Natural disturbance regime: The frequency and intensity of events that occur because of climate or animals (e.g., flood, fire, frost heave, drought, animal burrowing, or defoliation) that alter the structure of ecological systems or the processes that maintain ecological systems (IIRH, Version 4).

Natural Landscape (or ecosystem): one that developed by natural processes and that is self-organizing and self-maintaining.

Natural Resource Condition:

Niche: ecological role of a species in a community (Glossary Update Task Group 1998. Glossary of terms used in range management, 4th ed. Society for Range Management, Denver, Colorado, USA.)

Nitrogen fixation (fixers): The biological reduction of molecular nitrogen to chemical forms that can be used by organisms in the synthesis of organic molecules. (IIRH, Version 4).

Nonattainment Area: a geographic area within which the concentration of one or more criteria pollutants routinely exceeds national ambient air quality standards. PSD (Prevention of Significant Deterioration) requirements do not apply in non-attainment areas.

Nonvascular plants: Plants without specialized water or fluid conductive tissue (Xylem and phloen) that includes bryophytes, lichens and algae (Habich, 2001).

Normal variability or normal range of variability: The deviation of characteristics of biotic communities and their environment that can be expected given natural variability in climate and disturbance regimes. (IIRH, Version 4).

Noxious weed: An unwanted plant specified by Federal or State laws as being especially undesirable, troublesome, and difficult to control. It grows and spreads in places where it interferes with the growth and production of desired species (Habich, 2001).

OR… Any plant designated by a Federal, State, or county government to be injurious to public health, agriculture, recreation, wildlife, or any public or private property (Sheley et al. 1999).

Nutrient cycle: The cycle of nutrients, such as nitrogen and phosphorus, through the physical and biotic components of the environment; one of the ecological processes (Habich, 2001).

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Organic matter: Living plant tissue and decomposed or partially decomposed material from living organisms (IIRH, Version 4).

Oxidation: The loss of one or more electrons by an ion or molecule (SSSA 1997). Oxidation is a chemical process of decomposition whereby nutrients are released into the atmosphere instead of into the soil. Oxidation commonly increases as aridity increases (IIRH, Version 4).

Pasture: A grazing area enclosed and separated from other areas by a fence or natural barrier (Habich, 2001).

Pedestal (erosional): Plants or rocks that appear elevated as a result of soil loss by wind or water erosion (does not include plant or rock elevation as a result of non-erosional processes such as frost heaving). (IIRH, Version 4).

Pedon: The smallest body of one kind of soil large enough to represent the nature and arrangement of horizons and variability in the other properties that are preserved in samples. Pedons extend down through all genetic horizons (Habich, 2001).

Perennial Grassland: Area dominated by perennial native or introduced grasses with generally less than ?% canopy cover of shrubs or trees.

Perennial Plant: A plant that has a life span of 3 or more years (Habich, 2001).

Phenology: The study of periodic biological phenomena that are recurrent (e.g., flowering, seeding), especially as related to climate (Habich, 2001).

Physical crust: Thin surface layers induced by impact of raindrops on bare soil causing the soil surface to seal and absorb less water (IIRH, Version 4).

Plant decadence: In a plant community, decadence refers to an overabundance of dead or dying plants relative to what is expected for a site given the natural range of variability in disease, climate, and management influences (IIRH, Version 4).
Plant mortality: The death of a plant, or in a plant community, the death of a number of plants in the community (IIRH, Version 4)

Potential: (a) Capable of being, but not yet in existence; latent. (b) The ecological community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions; often referred to as “potential natural community.” (DOA/DOI, Regional Ecosystem Office 1995).

Potential Natural Community (PNC): The biotic community that would become established if all successional sequences were completed without interference by man under the present environmental conditions. Natural disturbances are inherent in development. PNCs can include naturalized nonnative species (Habich, 2001).

Potential natural vegetation: A historical term originally defined by A.W. Kuchler as the stable vegetation community which could occupy a site under current climatic conditions without further influence by people. Often used interchangeably with “potential natural community” (SRM 1999).

Precision: the closeness of repeated measurements of the same quantity (Elzinga, Salzer, and Willoughby 1998).

Preponderance of evidence: The rating of an attribute of rangeland health by observing where the distribution of indicators is in respect to the five categories used to rate each indicator associated with that attribute (IIRH, Version 4).

Prevention of Significant Deterioration (PSD): the air quality management and permit process (specified in Part C of the Clean Air Act), designed to limit the amount of additional (incremental) air quality degradation in attainment areas, or adverse impacts of Air Quality Related Values, while maintaining a margin for future industrial growth.

Proper Functioning Condition: Lentic riparian areas are functioning properly when adequate vegetation, landform, or debris is present to: dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality; filter sediment

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and aid floodplain development; improve flood-water retention and ground water recharge; develop root masses that stabilize islands and shoreline features against cutting action; restrict water percolation; develop diverse ponding characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterbird breeding , and other uses; and support greater biodiversity (USDI 1999).

Protocols: as used by this program, are detailed study plans that explain how data are to be collected, managed, analyzed and reported and are a key component of quality assurance for natural resource monitoring programs (Oakley et al. 2003). (NPS I&M website glossary)

Qualitative: Observational type data that is recorded but not measured (Habich, 2001).

Qualitative rangeland health assessment: The determination of the functional status of attributes through non-numerical observations of indicators. Qualitative assessments have an element of subjectivity (IIRH, Version 4).

Quantitative: Collection of data by measuring vegetation or soil characteristics (Habich, 2001).

OR… Data derived from measurements, such as counts, dimensions, weights, etc., and recorded numerically; may include ratios or other values. Qualitative numerical estimates, such as ocular cover and production estimates, are often referred to as "semi-quantitative." (IIRH, Version 4).

Quantitative rangeland health assessment: The determination of the functional status of an attribute(s) through measurement of vegetation, soil, or landscape characteristics that are indicators or can be used to derive indicators. Quantitative assessments have a known level of precision and accuracy, and require a quantitative reference (IIRH, Version 4).

Range condition: The present status of vegetation of a range site in relation to the climax (natural potential) plant community for that site. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site (SRM 1999).

Rangeland: A type of land on which the indigenous vegetation (climax or natural potential) is predominantly grasses, grasslike plants, forbs, or shrubs and managed as a natural ecosystem. If plants are introduced, they are managed similarly. Rangeland includes natural grasslands, savannas, shrublands, many deserts, tundras, alpine communities, marshes, riparian zones, and wet meadows (Habich, 2001).

Rangeland health: The degree to which the integrity of the soil, vegetation, water, and air, as well as the ecological process of the rangeland ecosystem, are balanced and sustained (Habich, 2001).

OR… The degree to which the integrity of the soil, vegetation, water, and air, as well as the ecological processes of the rangeland ecosystem, are balanced and sustained. Integrity is defined as maintenance of the structure and functional attributes characteristic of a locale, including normal variability (SRM 1999).

Rangeland Health Assessment: The process of estimating, measuring, or judging the value or functional status of ecological processes (e.g., rangeland health) in a location at a moment of time (based on IIRH, Version 4).

Rangeland similarity index: The present state of vegetation and soil protection of an ecological site in relation to the potential natural community for the site (Habich, 2001).

Reclamation: main objectives of reclamation activities include the stabilization of the terrain, assurance of public safety, aesthetic improvement, and usually a return of the land to what, within the regional context, is considered to be a useful purpose (SER, 2002).

Recruitment: The successful entry of new individuals into the breeding population (IIRH, Version 4).

Reference ecosystem: an ecosystem that can serve as the model for planning an ecological restoration project, and later serve in the evaluation of that project. In instances where the object of restoration consists of two or more kinds of ecosystems, the reference can be called the reference landscape or, if only a portion of a local landscape is to be restored, the reference landscape unit (SER, 2002).

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Reference state: The reference state is the state where the functional capacities represented by soil/site stability, hydrologic function, and biotic integrity are performing at an optimum level under the natural disturbance regime. This state usually includes, but is not limited to, what is often referred to as the potential natural plant community (PNC). See definition of “State” in Concepts section (IIRH, Version 4).

Rehabilitation: an activity that emphasizes the reparation of ecosystem processes, productivity and services (SER, 2002).

Relative dominance (composition): The percent of cover or production represented by a species or lifeform expressed relative to the total cover or production. It can also be based on biomass (IIRH, Version 4).

Relict area: A remnant or fragment of the historic climax plant community that remains from a former period when it was more widely distributed (Habich, 2001).

Remote Sensing: The technique of collecting information from a distance. Most common mediums used are aerial photography and satellite imagery.

Resilience: The capacity of ecological processes to recover following a disturbance. Resilience can be defined in terms of the rate of recovery, the extent of recovery during a particular period of time, or both (IIRH, Version 4).

OR… the ability of an ecosystem to regain structural and functional attributes that have suffered harm from stress or disturbance (SER, 2002).

Resistance: The capacity of ecological processes to continue to function without change following a disturbance (IIRH, Version 4).

OR… an ecosystem’s ability to maintain its structural and functional attributes in the face of stress and disturbance (SER, 2002).

Resolution: Resolution refers to the smallest viewable picture element (i.e., pixels) captured by a satellite or aerial sensor. A one-meter image has pixels that represent an area one meter by one meter on the ground. The highest resolution commercial satellites now aloft and operational carry two-foot sensors. At this resolution automobiles, boats, homes, trees, roads, and trails are easily detected. Aerial imagery can be flown and processed at resolution of three inches per pixel. (Resource Strategies, Inc., 2005.)

Resource use level: the level of use allowed within an area, based on the desired outcomes and land use allocations in the land use plan. Targets or goals for resource use levels are established on an area-wide or broad watershed level in the land use plan. Site-specific resource use levels are normally determined at the implementation level, based on site-specific resource conditions and needs as determined through resource monitoring and assessments (BLM H-1601-1, 2005)

Rhizomatous plant: A plant that develops clonal shoots by producing rhizomes. Rhizomes are horizontal underground stems that usually produce roots and shoots from nodes (SRM 1999).

Rill: A small intermittent water course with steep sides, usually only several centimeters deep. Rills generally are linear erosion features (Habich, 2001).

Riparian zone: The banks and adjacent areas of water bodies, water courses, seeps, and springs whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a more moist habitat than that of contiguous flood plains and uplands (Habich, 2001).

Runoff: The portion of precipitation or irrigation on an area which does not infiltrate, but instead is discharged by the area (SSSA 1997).

Sagebrush Areas: Areas with generally at least 5% sagebrush canopy cover.

Sagebrush Obligate Species: Species that use only sagebrush habitat to meet all life requirements (Paige and Ritter 1999, Knick et al. 2003).

Saltation: A particular type of momentum-dependent transport involving the rolling, bouncing, or jumping action of soil particles 0.1 to 0.5 mm in diameter by wind, usually at a height of <15 cm above the soil surface, for relatively short distances; the rolling, bouncing or jumping action of mineral grains, gravel,

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stones, or soil aggregates affected by the energy of following water; the bouncing or jumping movement of material downslope in response to gravity (SSSA 1997).

Sample: A set of sampling units as opposed to a single measurement Habich, 2001).

Scientific assessment: Under the Data Quality Act, an evaluation of a body of scientific or technical knowledge, which typically synthesizes multiple factual inputs, data, models, assumptions, and/or applies best professional judgment to bridge uncertainties in the available information, including state-of-science reports, meta-analyses, risk assessments, and others.

Scientific information: Under the Data Quality Act, factual inputs, data, models, analyses, technical information, or scientific assessments based on the behavioral and social sciences, public health and medical sciences, life and earth sciences, engineering, or physical sciences; any communication or representation of knowledge such as facts or data, in any medium or form.

Seral community: See seral stage.

Seral stage: The developmental stages of an ecological succession; synonymous with successional stage (Habich, 2001).

Shrub: A plant that has persistent woody stems and a relatively low growth habit, and that generally produces several basal shoots instead of a single bole. It differs from a tree by its low stature, less than 5 meters (16 feet), and nonarborescent form (Habich, 2001).

Similarity index (rangeland): The present state of vegetation and soil protection on an ecological site in relation to the historic climax plant community. *Synonym:* range condition. (SRM,1999).

Slope aspect: The predominate direction of slope of the land (Habich, 2001).

Soil: The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. The unconsolidated mineral matter on the surface of the earth that has been subjected to and influenced by genetic and environmental factors of parent material, climate (including moisture and temperature effects), macro and microorganisms, and topography (Habich, 2001).

Soil aggregates: A group of primary soil particles that cohere to each other more strongly than to other surrounding particles (SSSA, 1997).

Soil association: A kind of map unit used in soil surveys comprised of delineations, each of which shows the size, shape, and location of a landscape unit composed of two or more kinds of component soils or component soils and miscellaneous areas, plus allowable inclusions. The individual bodies of component soils and miscellaneous areas are large enough to be delineated at the scale of 1:24,000. Several bodies of each kind of component soil or miscellaneous areas are apt to occur in each delineation, and they occur in a fairly repetitive and describable pattern (Habich, 2001).

Soil classification: The systematic arrangement of soil units into groups or categories on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties (Habich, 2001).

Soil complex: A kind of map unit used in soil surveys comprised of delineations, each of which shows the size, shape, and location of a landscape unit composed of two or more kinds of component soils or component soils and a miscellaneous area, plus allowable inclusions in either case. The individual bodies of component soils and miscellaneous areas are too small to be delineated at the scale of 1:24,000. Several to numerous bodies of each kind of component soil or miscellaneous area are apt to occur in each delineation (SSSA, 1997).

Soil inclusion: One or more polypedons or parts of polypedons within a delineation of a map unit, not identified by the map unit name (i.e., it is not one of the named component soils or named miscellaneous area components). Such soils or areas are either too small to be delineated separately without creating excessive map or legend detail, occur too erratically to be considered a component, or are not identified by practical mapping methods (Habich, 2001).

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Soil map unit: A collection of soil areas or miscellaneous areas delineated in a soil survey. They may encompass one or more kinds of soil or one or more kinds of soil and miscellaneous areas, such as a rock outcrop. They are identified by a unique map symbol in a survey area. There are four kinds of map units: consociations, complexes, associations, and undifferentiated groups (Habich, 2001).

Soil/site stability: The capacity of a site to limit redistribution and loss of soil resources (including nutrients and organic matter) by wind and water (one of the three attributes of rangeland health). (IIRH, Version 4)

Soil structure: The combination or arrangement of primary soil particles into secondary units or peds. The secondary units are characterized on the basis of size, shape, and grade (degree of distinctiveness) (SSSA, 1997).

Soil survey: The systematic examination, description, classification, and mapping of soils in an area. Soil surveys are classified according to the kind and intensity of field examination (Habich, 2001).

Soil texture: The relative proportions of the various soil separates (sand, silt, and clay) in a soil (SSSA 1997).

Species composition: The proportions of various plant species in relation to the total on a given area. May be expressed in terms of relative cover, relative density, or relative weight (Habich, 2001).

*OR…*the taxonomic array of species present (SER, 2002).

Species redundancy: the presence of multiple species that play similar roles in ecosystem dynamics (SER, 2002).

Species richness: the number of different species present (SER, 2002).

Standing dead vegetation: The total amount of dead plant material, in aboveground parts, per unit of space, at a given time. (USDA 1997). This component includes all standing dead vegetation produced in the previous (not the current) growing season that is not detached from the plant and is still standing.

State: A recognizable, resistant, and resilient complex of soil and vegetation (Habich, 2001).

*OR…*A state is comprised of an integrated soil and vegetation unit having one or more biological communities that occur on a particular ecological site and that are functionally similar with respect to the three attributes (soil/site stability, hydrologic function, and biotic integrity) under natural disturbance regimes. (IIRH, Version 4).

State Implementation Plan (SIP): a document developed by each state government, and approved by EPA, which provides for the implementation, maintenance, and enforcement of air quality laws, standards, regulations, programs, and air pollution control strategies. Similar documents are called Federal Implementation Plans (FIPs) or Tribal Implementation Plans (TIPs).

Steady state: Vegetation states that are resistant to change. These plant communities change only as a result of a natural event that is beyond the normal range of events or normal human actions (Habich, 2001).

Stratification: the grouping together of similar site write-up areas (SWA) for sampling purposes. SWAs must have the same ecological site, forestland ecological site, or forest type in the same successional status class, or present vegetation community (Habich, 2001).

Stressors: physical, chemical, or biological perturbations to a system that are either (a) foreign to that system or (b) natural to the system but applied at an excessive [or deficient] level (Barrett et al. 1976:192). Stressors cause significant changes in the ecological components, patterns and processes in natural systems. Examples include water withdrawal, pesticide use, timber harvesting, traffic emissions, stream acidification, trampling, poaching, land-use change, and air pollution. (NPS I&M website glossary)

OR… external processes that stress the biota of an ecosystem. Sometimes called disturbance or perturbation (SER, 2002).

Structure (soil): The combination or arrangement of primary soil particles into secondary units or pedons. Secondary units are characterized on the basis of size, shape, and grade (degree of distinctness) (Habich, 2001).

Structure (vegetation): The height and area occupied by different plants or life forms in a community (Habich, 2001).

Subdominant (subordinate) species: Daubenmire (1968) defines subordinate species as “those species, which if removed singly, would not occasion much rearrangement with their ecosystem.” For the purposes of this document*, Interpreting Indicators of Rangeland Health*, subdominant plants are those within a community with less size-per-unit area as measured by biomass, production, or cover (IIRH, Version 4).

Succession: The progressive replacement of plant communities on a site that leads to the potential natural plant community (i.e., attaining stability). Primary succession entails simultaneous succession of soil from parent material and vegetation. Secondary succession occurs following disturbances on sites that previously supported vegetation and entails plant succession on the more mature soils (Habich, 2001).

Successional status: The present state of vegetation and soil protection of an ecological site in relation to the potential natural community for the site. Successional status is the expression of the relative degree to which kinds, proportions, and amounts of plants in a community resemble that of the potential natural community. The four classes of successional status ratings, expressed in terms of similarity to the potential natural community, are: 0-25 percent early seral class, 26-50 percent mid seral, 51-76 percent late seral and 76-100 percent PNC (Habich, 2001).

Succulent: Juicy, watery or pulpy, as the succulent stems of cacti (Habich, 2001).

*OR…*Generally a type of cactus (IIRH, Version 4).

Sustainable cultural practices: traditional human land uses that maintain biodiversity and productivity (SER, 2002).

Swath:

Terracette: “Benches” of soil deposition behind obstacles caused by water erosion(IIRH, Version 4).

Threshold: The boundary between any and all states, or along irreversible transitions, such that one or more primary ecological processes has been irreversibly changed and must be actively restored before returning to a previous state is possible (Habich, 2001).

OR… A transition boundary that an ecosystem crosses resulting in a new stable state that is not easily reversed without significant inputs of resources (IIRH, Version 4).

Tiller: A plant shoot that arises from the root or base of a plant (IIRH, Version 4).

Transformation: the conversion of an ecosystem to a different type of ecosystem of land use type (SER, 2002).

Transition: A shift in plant composition that results in relatively stable states, as reflected in composition and structure. These shifts can occur by natural forces or as a result of human actions (Habich, 2001).

*OR…*A shift between two states. Transitions are not reversible by simply altering the intensity or direction of factors that produced the change. Instead, they require new inputs such as revegetation or shrub removal. Practices, such as these, that accelerate succession (USDA 1997) are often expensive to apply.

Transition pathway: The mechanism that causes a change in plant community from one steady state to another (e. g., fire, drought, grazing, rest, chemical and mechanical treatment) (Habich, 2001).

Tree: A woody perennial, usually single-stemmed plant that has a definite crown shape and characteristically reaches a mature height of at least 5 meters (16 feet). Some plants, such as oaks (Quercus spp.), may grow as either trees or shrubs (Habich, 2001).

Trend: The direction of change in ecological status or resource value rating observed over time (Herrick et al. 2005).

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*OR…*as used by this program, refers to directional change measured in resources by monitoring their condition over time. Trends can be measured by examining individual change (change experienced by individual sample units) or by examining net change (change in mean response of all sample units). (NPS I&M website glossary)

Unhealthy rangelands: Rangelands on which degradation has resulted in the loss of ecological processes that function properly, and the capacity to provide values and commodities to a degree that external inputs are required to restore the health of the land (NRC 1994) (IIRH Volume 4).

Uses: utility of public land that may be authorized, allowed, or unauthorized. Uses include permitted activities such as livestock grazing, oil and gas development, and special recreation events for which case files exist. Uses also include activities that are allowed but not specifically permitted by the BLM, such as many dispersed recreation activities (Working definition). Also see definition for resource use level.

Users: Those individuals or groups utilizing public lands for authorized, allowed, or unauthorized uses. See definitions for uses and resource use level (working definition).

Vascular plant: Plants with vessels that conduct sap throughout the plant (Habich, 2001).

Vegetation: Plants in general, or the sum total of the plant life above and below ground in an area (Habich, 2001).

Vegetation attribute: The quantitative features or characteristics of vegetation that describe how many, how much, or what kind of plants are present. The most commonly used attributes are frequency, cover, density, production, structure, and composition (Habich, 2001).

Vegetation manipulation practices: Practices that are directed at changing vegetation production, species composition, and erosion control. These practices include root plowing, seeding, pitting, chaining, prescribed fire, herbicide application, prescribed grazing, and livestock exclusion (Habich, 2001).

Vegetation type: A kind of plant community with distinguishable characteristics described in terms of the present vegetation that dominates the aspect or physiognomy of the area (Habich, 2001).

Vesicular crust: A type of physical crust that contains numerous small air pockets or spaces similar to a sponge causing a reduction in infiltration (IIRH, Version 4).

Viable seed: Wildland plant seed that is capable of germination given appropriate environmental conditions (IIRH, Version 4).

Visibility: the optical quality of the atmosphere, sometimes quantified as the Visual Range, or the maximum distance at which it is just possible to differentiate (with the unaided eye) a prominent dark object against the horizon sky. Other measurement units include extinction (how light attenuates as it passes through the atmosphere) and deciviews (where 1.0 to 2.0 deciviews represent a just noticeable change in optical conditions under specific conditions.)

Vital Signs: are a subset of physical, chemical, and biological elements and processes of park ecosystems that are selected to represent the overall health or condition of park resources, known or hypothesized effects of stressors, or elements that have important human values. The elements and processes that are monitored are a subset of the total suite of natural resources that park managers are directed to preserve "unimpaired for future generations," including water, air, geological resources, plants and animals, and the various ecological, biological, and physical processes that act on those resources. Vital signs may occur at any level of organization including landscape, community, population, or genetic level, and may be compositional (referring to the variety of elements in the system), structural (referring to the organization or pattern of the system), or functional (referring to ecological processes). (NPS, I&M website glossary)

Warm season plants: Plants whose major growth occurs during the spring, summer, or fall and that are usually dormant in winter (Habich, 2001).

*OR…*A plant which makes most or all its growth during the spring, summer, and fall, and is usually dormant in winter; a plant that exhibits the C-4 photosynthetic pathway (SRM, 1999).

Water cycle: The capture, storage, and redistribution of precipitation (Habich, 2001).

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Watershed: Any area of land that drains to a common point. A watershed is smaller than a river basin or subbasin, but it is larger than a drainage or site. The term generally describes areas that result from the first subdivision of a subbasin, often referred to as a “fifth field watershed” (DOA/DOI, Regional Ecosystem Office 1995).

OR… The total area of land above a given point on a waterway that contributes runoff water to the flow at that point. A major subdivision of a drainage basin (Habich, 2001).

Weather: The current state of the atmosphere with regard to wind, temperature, cloudiness. moisture, and atmospheric pressure (Habich, 2001).

Well-managed rangelands: Rangelands that have properly functioning ecological processes, biotic integrity, and soil stability associated with human uses of the land (IIRH, Version 4).

Wind-scoured area: Areas, generally in interspaces, where the finer soil particles have blown away sometimes leaving residual gravel, rock, or exposed roots on the soil surface (IIRH, Version 4).

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P: Management Information System Report

EXPENDITURES RELATED TO ASSESSMENTS	2004	2005	Percent Change
BB - Assess Alaska Minerals	2,941,555	3,643,998	+23.88%
BF - Assess Hazmat Sites	4,790,569	3,996,833	-16.57%
BG - Assess Other Hazards (Non Hazmat or AML)	1,232,710	910,244	-26.16%
BP - Assess Watersheds	5,545,530	5,519,310	-0.47%
MJ - Evaluate Rangeland Health	7,466,483	6,843,430	-8.34%
BY - Assess Linear Recreation Resources	1,606,933	1,898,379	+18.14%
BZ - Assess Designated Rivers and Trails	877,344	858,326	-2.17%
ASSESSMENT SUBTOTAL:	**$24,461,123**	**$23,670,520**	**-3.23%**

EXPENDITURES RELATED TO INVENTORY	2004	2005	Percent Change
BA - Inventory Recreation Resources	2,237,033	2,293,504	+2.52%
BC - Inventory Non-Sec 106 Cultural and Paleontological	2,213,287	2,368,746	+7.02%
Subtotal Cultural and Recreational Program Elements:	**$4,450,321**	**$4,662,249**	**+4.76%**
BI - Acquire/Maintain Geographic Data	4,140,028	3,574,049	-13.67%
BJ - Approve Cadastral Survey Miles	4,981,748	5,445,919	+9.32%
BK - Complete Cadastral Field Miles Survey	37,037,470	34,781,705	-6.09%
BL - Collect Digital Cadastral Data	5,314,958	4,423,256	-16.78%
BM - Update Digital Cadastral Data	1,574,547	1,811,282	+15.04%
Subtotal Boundary and Ownership Program Elements:	**$53,048,751**	**$50,036,210**	**-5.68%**
BN - Inventory Water Resources	3,420,229	3,615,600	+5.71%
BO - Inventory Soil Resources	1,274,826	1,409,308	+10.55%
BR - Inventory Shrub/Grass/PJ Vegetation	948,854	705,712	-25.62%
BS - Inventory for Presence of Invasive and/or Noxious Weeds	2,943,116	2,256,088	-23.34%
BT - Inventory Forest/Woodland Vegetation	2,809,914	3,616,276	+28.70%
BU - Inventory Lakes/Wetland Areas	912,437	779,074	-14.62%
BV - Inventory Streams/Riparian Areas	3,834,646	3,790,961	-1.14%
BQ - Complete Ecological Site Inventory	826,388	797,560	-3.49%
CB - Inventory Wildlife/Plan Habitat	6,946,482	7,289,357	+4.94%
MC - Conduct Census of Wild Horse and Burro Areas	269,043	505,887	+88.03%
Subtotal Natural Resource Program Elements:	**$24,185,935**	**$24,765,823**	**+2.40%**
INVENTORY SUBTOTAL:	**$81,685,007**	**$79,464,283**	**-2.72%**

EXPENDITURES RELATED TO MONITORING	2004	2005	Percent Change
MD - Monitor Wilderness and WSAs	4,345,971	5,142,044	+18.32%
MG - Monitor and Maintain Hazmat & NRDAR Sites	362,935	363,171	+0.06%
MI - Monitor Air Resources/Climatic Conditions	555,138	1,126,042	+102.84%
MP - Monitor WHB HMAs	718,682	752,192	+4.66%
MT - Monitor Fuels Treatment	866,667	881,227	+1.68%
MU - Monitor Water Resources	2,882,425	3,010,528	+4.44%
MV - Evaluate Linear Recreation Management Objectives	443,222	543,226	+22.56%
MY - Monitor Non-Sec 106 Cultural and Paleontological	1,005,143	849,590	-15.48%
MZ - Monitor Fire Rehab Treatments	1,563,488	1,573,148	+0.62%
Subtotal Implementation Program Elements:	**$12,743,672**	**$14,241,167**	**+11.75%**
NB - Conduct Fluid Mineral Inspection and Enforcement	17,578,783	18,041,763	+2.63%
NF - Inspect and Verify Production at Mineral Material Sites	1,058,036	1,262,250	+19.30%
NG - Inspect and Verify Production at Coal Sites	2,047,764	1,383,642	-32.43%
NH - Conduct Realty Compliance Inspections	5,239,023	4,941,740	-5.67%
NI - Inspect Locatable Mineral Sites for Surface Compliance	5,106,989	4,528,232	-11.33%
NK - Conduct WH&B Compliance Inspections	1,136,733	1,107,277	-2.59%
NX - Inspect Commercial SRPs for Compliance	3,214,300	1,951,139	-39.30%
Subtotal Compliance Monitoring Program Elements:	**$35,381,628**	**$33,216,043**	**-+6.12%**
DJ - Evaluate Land Use Plans	1,371,385	904,152	-34.07%
MA - Evaluate Recreation Areas	2,323,392	2,380,482	+2.46%
MB - Evaluate Forest/Woodland Treatments	712,300	986,810	+38.54%
MF - Evaluate Designated Rivers and Trails	1,131,211	1,236,453	+9.30%
MK - Evaluate Weed Treatments	876,938	820,435	-6.44%
ML - Monitor Grazing Allotments	6,422,812	6,613,723	+2.97%
MN - Monitor Lake/Wetland Habitat	976,150	1,233,593	+26.37%
MO - Monitor Stream/Riparian Habitat	5,295,108	5,862,606	+10.72%
MQ - Monitor Terrestrial Habitat	4,528,256	4,988,574	+10.17%
MR - Monitor Species Populations	10,828,125	12,683,832	+17.14%
MX - Monitor Shrub/Grass Vegetation Treatments	315,667	271,142	-14.11%
Subtotal Effectiveness Monitoring Program Elements:	**$34,781,346**	**$37,981,801**	**9.20%**
MONITORING SUBTOTAL:	**$82,906,646**	**$85,439,011**	**+3.05%**

EXPENDITURES RELATED TO ASSESSMENTS, INVENTORY, AND MONITORING BY: PROGRAM ELEMENTS	2004	2005	Percent Change
ASSESSMENT SUBTOTAL	**$24,461,123**	**$23,670,520**	**-3.23%**
INVENTORY SUBTOTAL	**$81,685,007**	**$79,464,283**	**-2.72%**
MONITORING SUBTOTAL	**$82,906,646**	**$85,439,011**	**+3.05%**
TOTAL:	**$189,052,775**	**$188,573,814**	**-0.25%**

EXPENDITURES RELATED TO ASSESSMENT, INVENTORY, AND MONITORING PROGRAM ELEMENTS BY: RESOURCE	2004	2005	Percent Change
RECREATION AND CULTURAL SUBTOTAL	**$19,397,836**	**$19,521,888**	**0.64%**
NATURAL RESOURCES SUBTOTAL	**$76,247,824**	**$79,943,843**	**4.85%**
LAND AND MINERALS SUBTOTAL	**$93,407,115**	**$89,108,082**	**-4.60%**
TOTAL:	**$189,052,775**	**$188,573,814**	**-0.25%**

P': Program Element Descriptions

Assessment Project Elements for Cultural and Recreational Use

BY Assess Linear Recreation Resources

Report all procurement and labor costs of baseline data collection and assessments associated with rivers (including eligible and suitable Wild and Scenic Rivers prior to designation), trails, and byway work. The work includes baseline inventory and assessment of rivers and trails that are being evaluated for potential congressional designation. Social and economic baseline collection or studies and visitor/resident customer assessment associated with rivers, trails, and byways are appropriate costs for this program element.

This work does not include baseline data collection and assessments for either NLCS linear units including congressionally designated Wild or Scenic Rivers and National Scenic and Historic Trails (see BZ) or recreation areas and NLCS units commonly reported in acres (see BA or BE).

BZ Assess Designated Rivers and Trails

Work and costs associated with the collection and analysis of baseline data associated with designated Wild and Scenic Rivers and designated Scenic and Historic Trails. Baseline data collection and analysis of social, economic, or scientific information of Congressionally designated rivers or trails needed to develop management plans or for management activities is appropriate.

Baseline data collection for determining suitability and eligibility for Wild and Scenic Rivers should be charged to program element BY.

Assessment Project Elements for Boundary and Ownership Use

BF Assess Hazmat Sites

The following activities are associated with this program element. All costs (labor and operations including equipment, travel, materials and contracts) associated with the planning, conducting, overseeing and documenting of the activities described below should be charged to this program element.

1. Site verifications/evaluations/assessments/inspections of known or suspected hazardous materials sites that are consistent with the National Contingency Plan (NCP) and BLM Handbook 1703-1 "CERCLA Response Actions Handbook", and known or suspected releases of petroleum under the Oil Pollution Act (OPA) that are not associated with currently operating oil fields.

2. Preliminary analyses/initial assessments/environmental site assessments (ESA) completed for realty actions that are consistent with BLM Handbooks H-2101-4 "Pre-acquisition ESA Handbook" and the draft disposal handbook.

3. Facility assessments/corrective measures studies performed under section 7003 of the Resource Conservation and Recovery Act (RCRA) and assessments/corrective measures studies for Underground Storage Tanks under RCRA. This does not include actions associated with environmental compliance inspections, such as CASHE assessments, which should be coded to BG.

4. NRDAR site scoping/pre-assessment screening and assessment plans.

5. Community relations actions associated with the above activities including the development of community relations plans.

6. Creating and maintaining case/administrative record files for known or suspected hazardous materials sites.

7. Training activities associated with the above activities, including participation in the development of training and policy/guidance to improve processes described above.

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BG Assess Other Hazards (Non Hazmat or AML)

This program element is associated with all natural, man-made, and noncompliance situations that pose health, safety and/or environmental risk(s) or wildfire risk(s) to the public. Examples include cast away equipment, abandoned structures, unexploded ordnance, solid waste dumps, unstable slopes, potential rock slides, caves, all activities associated with risk assessments in the Wildland Urban Interface, as well as environmental and occupational safety and health deficiencies at BLM facilities. This program element does not include verifications/evaluations/assessments/inspections/studies of hazardous materials sites or hazardous substances releases, nor preliminary analysis/initial assessments/environmental site assessments completed for realty actions. These activities are covered under program element BF.

Physical safety hazards at abandoned mines are to be coded to BH.

Assessment Project Elements for Natural Resource Use

BB Assess Alaska Minerals

Report all procurement and labor costs related to Alaska mineral inventories and assessments of solid mineral resources on special issues or within mining districts, BLM resource planning areas, or other assigned geographic areas.

Special studies/assessments are performed to establish baseline data concerning the occurrence potential, quantity, character, economic, and environmental aspects of mineral resources on public lands.

BP Assess Watersheds

A watershed-based land health evaluation addresses, at a minimum: the four Fundamentals of Land Health; achievement of land health standards, conformance of land use activities with guidelines, and whether an existing management practice is a significant factor for not achieving standards.

A watershed assessment is an analysis and interpretation of the physical, ecological, and landscape characteristics of a watershed using scientific principles to describe conditions as they affect various resources of concern. It addresses a broader suite of issues and resources than a watershed-based land health evaluation. A watershed-based land health evaluation can be a subset of a broader watershed assessment.

Code to Program Element BP all costs associated with watershed assessments and watershed-based land health evaluations and determinations, such as:

1. Interdisciplinary review of all available data and information to evaluate achievement of Land Health Standards and land use plan or other management objectives.
2. Conducting public outreach for the assessment/evaluation.
3. Display, interpretation and synthesis of information.
4. Preparing the assessment report and determination document.
5. GIS support, data management support, contracts/Interagency agreements, equipment purchase/lease/rental.

MJ Evaluate Rangeland Health

Land Health Evaluations and determinations include all costs associated with the reportable unit such as:

1. Interdisciplinary review of all available data and information to evaluate Land Health Standards and achievement of land use plan objectives in an allotment.
2. Conducting public participation in an allotment evaluation process.
3. Preparing the allotment evaluation report.
4. Evaluating data (including allotment evaluations) to assess achievement of rangeland health standards and conformance with the guidelines for grazing management.

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5. Preparing the document that answers the following questions relative to land health standards: i) is the standard being met? ii) is significant progress being made? iii) is livestock grazing a significant factor in failing to achieve the standards and conform with the guidelines?
6. GIS support, data management support, contracts/Interagency agreements, equipment purchase/lease/rental.
7. Compiling and evaluating appropriate data, determining achievement of land health standards, conformance with guidelines, and documenting the determination should be coded to this program element.

Inventory Project Elements for Cultural and Recreational Use

BA Inventory Recreation Resources

Report all procurement and labor costs related to recreation inventories and assessments of recreation resources in special and extensive recreation management areas. The baseline data collection relates directly to assessment of Special and Extensive Recreation Management Areas, fee and non-fee recreation sites, Natural Areas, caves, Natural and National Historic Landmarks, National Monuments, National Conservation Areas, Recreation Areas, Watchable Wildlife Areas, and open and closed Off Highway Vehicle use areas.

This work does not include Wilderness, Wilderness Study Areas (see BE), Wild and Scenic Rivers, National Scenic and Historic Trails (see BZ), and other Linear Recreation Designations including limited OHV areas which require specific route designations (BY).

Includes acres covered under special studies/assessments performed to establish baseline data concerning the character, condition, and nature of recreation resources on public lands, including both developed and undeveloped. This also includes economic and social baseline collection or studies, visitor/resident customer assessments or studies as they relate to above recreational resources, and planning related inventories, such as for OHV designations and visual resource management classifications. Charge all costs associated with presidential or congressional requests for information relating to the potential designation of a National Monument or National Conservation Area to program element AE.

BC Inventory Non-Sec 106 Cultural and FLPMA/NEPA Paleontological Resources

Includes all labor and procurement costs of cultural resources and paleontological inventory, including completing and automating site records and digitizing site locations and paleontological localities in GIS. Work includes Class II and III cultural inventories. Also, includes all costs associated with gathering, compiling, and analyzing cultural resource and paleontological resource data.

The acres of public lands inventoried at a Class III level in a given fiscal year as a result of ""pro-active" "cultural resource inventories (i.e., non-section 106 inventory) completed under Sec. 14 of ARPA and/or Sec. 110 of NHPA. Class II ""sample"" units or transects, inventoried to class III standards, should be included in the acres reported. Also, the acres of public lands surveyed on-the-ground to comply with FLPMA, NEPA or Bureau planning requirements to determine the presence and importance of paleontological resources, whether done by agency staff or paleontological permittees. When doing paleontological work, this program element will be used along with a four digit "PALE" project code to denote paleontological inventory."

Inventory Project Elements for Boundary and Ownership Use

BI Acquire/Maintain Geographic Data

Geographic Data Acquisition and Maintenance includes: geographic features such as roads, rivers, hydrography, watershed (hydrologic unit) boundaries, place names, elevation, ownership, general vegetation, ortho photos and remote sensing images.

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Work includes: Geographic Data Acquisition and Maintenance such as purchasing 7½ or 15 minute topography maps for general office use, initial creation or maintenance of geographic data that supports many program elements, updating hydrography to meet the Federal Geographic Data Committee (FGDC) standard (National Hydrography Database) and Bureau standards (and associated attributing), and delineating watershed boundaries to meet FGDC and Bureau standards. Also includes management of all GIS spatial data in ArcLibrarian, ArcSDE or directories.

DOES NOT include costs associated with acquisition or maintenance of data related to specific Planning, Inventory, Use Authorization, Implementation or Monitoring efforts, these costs should be coded to the program element that is the driving reason for the GIS support. Examples include:

- Purchase of aerial photos for the purpose of an Order III Soil Survey. Costs should be coded to BO.
- Acquisition of remote sensing images for classification of wildlife habitats. Costs should be coded to BN

Can include GPS activities for non-cadastral features, if the data relates to many programs.

Note: Spatial data preparation, collection, and maintenance by GCDB processes and conversion of GCDB data to Arc coverage and GIS validation (passes Topocheck, the E4 errors have been reviewed and edgematch errors are corrected) should be coded to program elements BL or BM. Maintenance of transferred Arc coverage should be coded to program element BI.

BJ Approve Cadastral Surveys

All work from the point of draft field notes and plat completion through examination, acceptance and official filing (filing is a step in the Cadastral Survey process and, therefore, is not included in program element BX). All costs associated with supplemental plats, mineral surveys, remonumentation, and water rights office review. Control miles are to be reported only when the monument being tied to is a PLSS monument. Includes consultation costs associated with Indian Trust lands: Trust programs on Indian lands (cadastral survey and minerals on Trust lands), assessing the impacts of public land activities on Indian Trust lands, and the analysis of the impact of public land activities on off reservation treaty rights. To be reported in the workload measure comment field: the total miles of supplemental plats. The BJ Workload Measure is approved miles from official surveys (miles returned in official field notes, including distances returned in official field notes or plat for ties to geodetic control), mineral surveys and supplemental plats. This Workload Measure includes all miles, regardless of the status of the land or the funding source.

BK Complete Cadastral Field Miles Survey

All survey work up to and including the point that the draft field notes and plat are completed, including client consultation, special instruction preparations, and records research. All costs associated with administrative surveys with output of miles. Control miles are to be reported only when the monument being tied to is a PLSS monument. Includes consultation costs associated with Indian Trust lands: Trust programs on Indian lands (cadastral survey and minerals on Trust lands), assessing the impacts of public land activities on Indian Trust lands, and the analysis of the impact of public land activities on off-reservation treaty rights.

To be reported in the workload measure comment field: the number of all survey monuments set during the actual field survey process; the number of administrative miles; the number of control miles to non-PLSS corners.

BL Collect Digital Cadastral Data

Includes all costs associated with initial coordinate collection, attribution, and integration of cadastral data Geographic Coordinate Data Base (GCDB), including use of data from another organization, preparing the ArcInfo coverage and Geographic Information System (GIS) validation. Costs include contract collection, contract inspection, establishing partnerships, and travel for GCDB and Cadastral Technical Advisory Committee (CTAC) meetings. Costs include submittal to the GCDB National Home Page. Only annual accomplishments, not cumulative are reported. Includes consultation costs associated with Indian Trust lands: Trust programs on Indian lands (cadastral survey and minerals on Trust lands), assessing the

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impacts of public land activities on Indian Trust lands, and the analysis of the impact of public land activities on off reservation treaty rights.

This Program Element includes all costs, except costs of workload measure BM, regardless of the status of the land (including Indian Trust lands) or the funding source.

This workload measure will be reported only after the townships are collected, GIS validated and submitted to the GCDB National Home Page. For townships that cannot be posted on the Home Page due to Indian Trust issues, the townships may be reported if the survey information has been GIS validated, and is made accessible to the stakeholders.

Listed separately in the BL comment field will be the number of townships collected and submitted to the GCDB National Home Page: 1) in partnership and 2) with Indian Trust Land.

BM Update Digital Cadastral Data

Includes all costs associated with establishing partnerships, the inspection and conversion of Geographic Coordinate Data Base (GCDB) updated by the BLM or another agency, tribal, state or local government, or private organization (the township coordinates have been collected to BLM specifications), including operations and maintenance (O&M) by another agency, government, or organization. Costs include the converting of Public Land System Coordinate Computation System (PCCS) collected townships to Geographic Measurement Management (GMM). Costs include submittal to the GCDB National Home Page. Only annual accomplishments, not cumulative are reported. Includes consultation costs associated with Indian Trust lands: Trust programs on Indian lands (cadastral survey and minerals on Trust lands), assessing the impacts of public land activities on Indian Trust lands, and the analysis of the impact of public land activities on off reservation treaty rights. Costs for producing amended protraction diagrams will also be coded to this program element.

This workload measure will be reported only after the townships are collected, GIS validated and submitted to the GCDB National Home Page. For townships that cannot be posted on the Home Page due to Indian Trust issues, the townships may be reported if the survey information has been GIS validated, and is made accessible to the stakeholders.

Amended protraction diagrams: Each amended protraction diagram produced will count as one unit under this workload measure.

Listed separately in the BM comment field will be the number of townships updated and submitted to the GCDB National Home Page: 1) in partnership and 2) with Indian Trust Land.

Inventory Project Elements for Natural Resource Use

BN Inventory Water Resources

Number of inventory stations at which water resources inventory takes place. This includes data collected on the quality and quantity of surface water and groundwater. Also includes inventory of stream-flow (discharge), temperatures associated with water thermal regime, turbidity, sediment, electrical conductivity, pH, precipitation, and other water quality constituents. This Program Element normally includes costs associated with measuring stream channel geometry for classifications purposes, and floodplain inventory. Any exceptions are noted above in the first section of Examples/Notes.

If the inventory station can be directly associated with a single BLM use authorization, those costs should be coded to the Program Element associated with that use authorization (for example, baseline inventory in a groundwater aquifer that could be affected by a coal lease would be coded to EL). If the inventory cannot be associated with a single use authorization, or if the inventory is rooted in multiple-use authorizations and there is no logical predominant use authorization that can be determined and used, then use this Program Element, BN.

Cost categories that apply to this Program element are costs associated with collection, analysis, interpretation of water resources inventory data including the cost, installation, and maintenance of equipment, laboratory costs, and publication of data, and data management.

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BO Inventory Soil Resources

Soils Inventory includes all costs associated with:

1. labor in the field and the office
2. data management support
3. GIS support
4. contracts/interagency agreements
5. equipment purchase/lease

BQ Complete Ecological Site Inventory

Includes all labor and operational costs associated with conducting Ecological Site Inventories (ESI), such as: 1) Planning for the inventory, 2) Labor in the field and the office, 3) GIS support, 4) Data management support, 5) Contracts/Interagency agreements, and 6) Equipment purchase/lease/rental.

Ecological Site Inventory is the Bureau of Land Management's standard vegetation inventory procedure. It involves the mapping of ecological sites, vegetation communities, and the systematic sampling of these sites to, at a minimum, determine above ground annual production on all vegetation species. All techniques used are patterned after those identified in the Natural Resource Conservation Services' National Range and Pasture Handbook 1997.

Information collected is used to determine site potential for numerous land uses, including what are appropriate benchmarks for ecological condition for that site.

BR Inventory Shrub/Grass/PJ Vegetation

Area inventoried to determine baseline conditions in shrub and grassland vegetation types including qualitative upland assessment (inventory), GAP analysis, vegetation cover type inventories not covered more specifically in other inventories (see below) and other remote sensing methods collecting general or specific vegetation baseline data. Includes shrub and grass lands having 10% or less tree canopy cover with an intent to manage as shrub and grass lands in the future. Forested areas intended to be converted to rangelands are to be considered shrub and grass lands, not forestlands, regardless of the amount of existing canopy cover.

Includes all labor and operating costs associated with accomplishing the shrub, grassland inventory defined above.

Does not include: Watershed assessments or monitoring, Ecological Site Inventory (BQ), Forest Vegetation Inventory (BT), Weed Inventory (BS), Wildlife and Plant Inventory (CB), Rangeland Health Standards (MJ).

BS Inventory for Presence of Invasive and / or Noxious Weeds

Total number of acres inventoried for the presence of non-native invasive plants and/or noxious weeds.

All appropriate labor and operational costs associated with weed treatments. This could include, but is not limited to: employee salary, travel costs, vehicle costs, purchase of equipment (GPS units, etc.), contract costs and map costs (GIS, base maps).

BT Inventory Forest/Woodland Vegetation

Acres of forest and woodland inventoried by methods that quantify the spatial distribution, composition, and rates of change for forest parameters -- within specified levels of precision -- for the purpose of developing management prescriptions. Forested land is defined as land having 10% or greater tree canopy cover with an intent to manage for tree canopy cover in the future. Forested areas intended to be converted to rangelands are not to be considered forested land, regardless of the amount of existing canopy cover (report this type of inventory under Workload Measure BR).

Appropriate charges include actual inventory or identified surveys, and all costs associated with planning, preparing and administering any inventory or identified survey contracts. Overhead and support costs may

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be charged to this program element. While overhead and support costs may be charged to a program element, they must not be charged to subactivity 5900 (See Instruction Memorandum No. 98-87).

BU Inventory Lakes/Wetland Areas

Number of acres of lakes or wetlands inventoried. This includes data collection that focuses on understanding the condition and/or functionality of both fisheries habitat and wetland/shoreline vegetation resources and presence/absence, abundance, range and/or distribution of lake/reservoir/wetland species (including Special Status Species) in order to describe existing baseline conditions. The scale of mapping for wetlands is generally smaller, and more discrete, than other Bureau vegetation inventories, and can supplement those efforts. Aquatic habitat inventories are generally geared toward species of specific interest, while wetlands inventories tend to focus more on lakeside vegetation. Reassessment of condition utilizing proper functioning condition or other methodologies should be reported under MN. Species population monitoring, where the trend of the species is assessed, should be coded to MR.

All labor and operating costs associated with documenting habitat conditions for lake/reservoir aquatic species and lake/reservoir wetland vegetation.

BV Inventory Streams/Riparian Areas

Number of miles of stream/river habitat or riparian vegetation inventoried. This includes data collection that focuses on understanding the condition of both instream aquatic habitat, channel morphology, hydrology and streambank riparian resources and presence/absence, abundance, range and/or distribution of riparian-dependent or aquatic species(including Special Status Species) in order to describe existing conditions. The scale of mapping is generally smaller, and more discrete, than other Bureau vegetation inventories, and can supplement those efforts. Aquatic habitat inventories are generally geared toward species of specific interest, while riparian inventories tend to focus more on streamside conditions. Reassessment of condition utilizing proper functioning condition or other methodologies should be reported under MO.

All labor and operating costs associated with documenting habitat condition and species occurrence for aquatic species and streamside riparian vegetation.

CB Inventory Wildlife/Plant Habitat

Includes data collection, analysis and reporting to provide understanding of presence or absence, abundance, range and/or distribution status of fish, wildlife, fungi and plant species (including Special Status Species and Survey and Manage Species under the Northwest Forest Plan) and habitats in order to describe existing conditions. The scale of mapping is generally smaller than other Bureau vegetation inventories and can supplement those inventory efforts. Wildlife and plant inventory is typically based on a specific species of interest, and characterizes baseline species status and habitat parameters. It is not limited to Shrub, Grassland, Woodland or Forest inventory. Species population monitoring, where the trend of species is assessed, is coded to MR. Inventory for project clearances is coded to the program element most closely associated with the project.

All labor and operating costs associated with documenting species occurrence for fish, wildlife, fungi and plant species and their habitat parameters.

Section 7 consultation costs are NOT included in this program element. Section 7 costs are coded to the program element driving the need for the consultation.

MC Conduct Census of WH&B Areas

Includes all labor and operational costs associated with: Census of animal populations in Herd Management Areas including: flight costs, field visits and documentation.

Monitoring Project Elements for Implementation

MD Monitor Wilderness and Wilderness Study Areas

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Includes all costs including labor and procurement in support of monitoring Wilderness and Wilderness Study Areas. Monitoring is defined as an actual visit by an authorized person to an area to evaluate the integrity of the area's wilderness values.

Monitoring should be completed at a minimum of once per month, in the months that area is accessible to the public, or on a different frequency basis if in accordance with an alternative surveillance plan. Do not include the cost of compliance work related to authorized uses.

Include costs of law enforcement when performing compliance, patrol, enforcement, and investigations to protect WSAs.

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MG Monitor and Maintain AML, Hazmat & NRDAR Sites

The following activities are associated with this program element. All costs (labor and operations including equipment, travel, materials and contracts) associated with the planning, conducting, oversight and documentation of the activities described below should be charged to this program element.

1. Monitoring of hazardous materials and oil spill sites to ensure human health and safety, and protection of the environment, or comply with regulatory requirements or orders. This does not include sampling and analysis conducted as part of a verification/assessment/inspection of a hazardous materials site. Those activities are included in BF.
2. Monitoring to determine the success of completed restoration projects undertaken to restore natural resource injuries.
3. Long term maintenance of a hazardous materials site where a response action or remediation has been completed.
4. Long term maintenance at sites where restoration activities have been completed.
5. Monitoring of abandoned mine land sites where cleanup work has been completed. This could include water-quality monitoring, and checking on durability of safety fixes to measure success and possible need for future follow-up actions.
6. Training activities associated with the above activities, including participation in the development of training and policy/guidance to improve processes described above.

MI Monitor Air Resources/Climatic Conditions

Includes all work associated with air resource and climatological monitoring and evaluation including planning for, collecting and evaluating the data. This includes GIS support, equipment, data management, contracts/interagency agreements and other support.

Monitoring is reported when all scheduled monitoring is completed in the Fiscal Year. For example, although the station is read quarterly, reporting will only be completed once when all studies are collected and documented for the year.

MP Monitor WH&B Herd Management Areas

Includes all labor and operational costs that are primarily associated with monitoring and inventorying herd and habitat for wild horse and burro management for: the establishment or adjustment of AML, monitoring condition of animals, vegetation and water sources, inventory assessments, HMA improvement projects should be charged to Program Element JB or JH depending on the habitat.

MT Monitor Fuels Treatment

Includes work associated with monitoring and evaluating the short term effects of fuels management treatments (primarily funded from the 2823 & 2824 subactivities). In this context, treatment includes chemical, mechanical, vegetation seeding or revegetation treatments, prescribed fires, wildland fire for resource benefit or a combination of these treatments. It may also include the monitoring of weed populations, or other vegetation populations and evaluating their responses to the fire or treatment. Monitoring of long-term effects of treatments conducted for the objective of hazardous fuels reduction can be charged to the 2823 subactivity, while resources programs pay for long-term monitoring of treatments conducted for other purposes, including the reintroduction of fire into the ecosystem.

MU Monitor Water Resources

This includes data collected on the quality and quantity of surface water and groundwater. Also includes monitoring of flows, water levels, temperatures, precipitation, turbidity, sediment, pH, or any other water quality constituents. This Program Element also includes costs associated with measuring changes in stream channel geometry, and measuring changes in floodplain characteristics. Source Water Assessment Monitoring, drinking water sampling and testing, and Sole Source Aquifer Monitoring stations costs should be assigned here. Exceptions are noted above in the first section of Examples/Notes.

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If the monitoring station can be directly associated with a single BLM use authorization, those costs should be coded to the Program Element of that use authorization (for example, implementation monitoring of water quality for a coal lease would be coded to EL). If the station and its costs cannot be associated with a single use authorization, or if the work is rooted in multiple-use authorizations, then use this Program Element, MU.

Cost categories that apply to this Program Element are costs associated with collection, analysis, interpretation of water resources monitoring data, installation, and maintenance of equipment, laboratory costs, and publication of data, and data management.

MV Evaluate Linear Recreation Management Objectives

Rivers (eligible and suitable prior to designation), trails, and/or byways management objectives that are evaluated in a given year. Costs can include monitoring data collection, data evaluation, permanent documentation, and reporting. Work can be reported in absence of a management plan, if the evaluation is done pursuant to a decision

The process for this program element is as follows:

1. Schedule evaluation in AWP based on management plan or management decision.
2. Identify specific recreation objectives to be evaluated;
3. document the evaluation results in a permanent bureau record.

Does not include evaluations for NLCS linear units, designated Wild and Scenic Rivers and National Scenic and Historic Trails which are charged to MF. Also excludes recreation areas reported under MA.

MY Monitor Non-Sec 106 Cultural Properties and Paleontological Localities

Includes all labor and procurement costs related to monitoring cultural property condition and detecting and deterring looting and vandalism. Cultural properties monitored through the efforts of non-BLM personnel (e.g., volunteers, site stewards, cooperators) should be reported, even though no BLM labor or procurement costs may be attributed to this work. This program element does not include any labor and procurement costs related to monitoring approved activities of cultural resource and paleontological permittees; the latter should be reported under program element "FB."

The number of individual cultural properties and paleontological localities monitored by BLM personnel and non-BLM personnel (e.g., volunteers, site stewards, etc.) to assess resource condition and detect and deter looting and vandalism. Only those specific cultural properties and paleontological localities that have been visually examined through an on-the-ground visit should be reported. This program element will be used along with a four-digit "PALE" project code to denote paleontological localities monitored. This program element should not be used to code labor and operations costs related to monitoring cultural properties as a condition or outcome of section 106 compliance; that level of site monitoring should be coded to the appropriate use authorization program element.

MZ Monitor Fire Rehab Treatments

Includes labor and other costs associated with the monitoring and evaluation of Emergency Fire Rehabilitation (2822) subactivity driven projects and actions for up to three growing seasons after fire control. This includes monitoring plot establishment, reading of studies, data analysis and preparation of an evaluation report. Acres monitored are reported each year that studies are read and when the evaluation report is completed Monitoring and/or evaluations of weed invasion or control in burned areas conducted with EFR funds should be reported in Program Element MK (Weed Treatments Evaluated). Monitoring and/or evaluations of wildfire or rehabilitation treatments impacts on wildlife populations, recreational activities, cultural resources, etc must be paid for with the appropriate subactivity funds.

Monitoring Project Elements for Compliance

NB Conduct Fluid Mineral Inspection and Enforcement

Fluid Minerals mean oil and gas or geothermal resources. Compliance inspections are actions conducted after lease operations have been authorized to ensure that operations are conducted in accordance with

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the regulations, lease terms, Onshore Operating Orders, notices to lessees and permit conditions of approval. A C compliance inspection begins when a well is permitted and ends when final abandonment is approved. Compliance inspections are broken down into six categories: drilling, production, environmental, undesirable events, workovers and abandonment. Workload indicators are the number of compliance inspection types completed. Includes all support costs; all costs to create and to update manual and automated records; costs associated with coordinating with other offices and industry; costs associated in development of inspection plan matrix; and, conducting inspection and compliance activities. Does not include Geophysical inspections/compliance (see NH). All law enforcement duties including patrol, enforcement, and/or investigative activities related to the Fluid Mineral program should be charged to this program element. This includes all labor and operational dollars to deter, detect, investigate or prosecute violations of rules, regulations or laws pertaining to this program. This also includes work performed by law enforcement officers to protect volunteers, employees or government property associated with this program.

NF Inspect, and Verify Production at Mineral Material Sites

Inspection functions involve monitoring actions from authorizations through completion of a project. Inspections also include all work with authorized users to correct operations which violate use stipulations and/or conditions of approval as well as other post-permit actions. This program element includes all work associated with conducting inspections and production verification mineral material disposals only. Inspection and production verification shall be conducted consistent with existing manuals, handbooks and other guidance.

Coal Inspections and Production Verifications should be coded to NG. NonEnergy Leasable Mineral, and Indian sand and gravel Inspections and Production Verifications should be coded to OB.

All law enforcement duties including patrol, enforcement, and/or investigative activities related to the inspection and verification of production at mineral material sites should be charged to this program element. This includes all labor and operational dollars to deter, detect, investigate or prosecute violations of rules, regulations or laws pertaining to this program. This also includes work performed by law enforcement officers to protect volunteers, employees or government property associated with this program.

NG Inspect and Verify Production at Solid Mineral Sites

Inspection functions involve monitoring actions from authorizations through completion of a project. Inspections also include all work with authorized users to correct operations that violate use stipulations and/or conditions of approval. Production verification includes all actions to collect and analyze data for independent verifications of production reported by a lessee action. This program element includes all work associated with conducting inspections and production verification on Federal and Indian exploration licenses or permits and, coal use authorizations or leases including SITLA leases. Compliance consists of inspection and production verification actions that occur after permit, license or lease issuance. This workload measure includes compliance for coal. This workload measure also includes the identification of activities that are in non-compliance for this program. All law enforcement duties including patrol, enforcement, and/or investigative activities related to the inspection and verification of solid mineral sites should be charged to this program element. This includes all labor and operational dollars to deter, detect, investigate or prosecute violations of rules, regulations or laws pertaining to this program. This also includes work performed by law enforcement officers to protect volunteers, employees or government property associated with this program.

NH Conduct Realty Compliance Inspections

Realty compliance inspections include: performing onsite inspections of various authorized lands actions, documenting results of inspection (e.g. , project is in compliance, project is not in compliance, projects needs authorization modified to accommodate existing development); obtaining management review/approval of compliance report and recommendations: issuing of notice of noncompliance, etc. All law enforcement duties including patrol, enforcement, and/or investigative activities related to realty compliance should be charged to this program element. This includes all labor and operational dollars to deter, detect, investigate or prosecute violations of rules, regulations or laws pertaining to this program. This also includes work performed by law enforcement officers to protect volunteers, employees or

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government property associated with this program. Includes standardized periodic "stewardship" compliance inspections of access, conservation, and (historic) scenic easements acquired by purchase, donation, and/or exchange, or retained through reservation. State Offices will determine frequency of "stewardship" inspections based on specific "risk" factors. Inspections may be conducted by realty and/or benefiting resource program managers.

NI Inspect Locatable Mineral Sites for Surface Management Compliance

Work includes all actions taken to inspect notices and plans of operations under 43CFR3809, and use/occupancies under 43CFR3715 for compliance with the terms of the authorizing document(s) and regulations. This program element should be used for all inspection work, including the writing of inspection reports, case file documentation of inspections and travel time to and from the site inspected. The program element includes actions taken by non-law enforcement personnel pursuant to notices of noncompliance, noncompliance orders, and other enforcement actions described under the 43 CFR 3809 and 3715 regulations. Use only for 43 CFR 3809 notices, plans of operations and 3715 use/occupancies. Work does not include inspections of abandoned mine lands. Use BH, HP or JK for these inspections.

All law enforcement duties including patrol, enforcement, and/or investigative activities related to the inspection for surface management compliance should be charged to this program element. This includes all labor and operational dollars to deter, detect, investigate or prosecute violations of rules, regulations or laws pertaining to this program. This also includes work performed by law enforcement officers to protect volunteers, employees or government property associated with this program.

NK Conduct WH&B Compliance Inspections

This element includes all labor and operational costs associated with conducting compliance inspections of the terms and conditions agreed to by an adopter by signing the Private Maintenance and Care Agreement (PMACA).

Some animals adopted through a Private Maintenance and Care Agreement [PMACA] receive a compliance field inspection. BLM personnel, approved volunteers or other authorized officers perform field inspections prior to titling.

Include all costs for volunteers conducting inspections, all costs associated with repossession including care, time and travel relating to all compliance activities, response to mistreatment complaint, time and travel to slaughterhouses for each animal inspection resulting from reports or complaints of missing titles, data entry and documentation resulting from compliance activities, reimbursement of funds from adopter for escaped animals [as cited in regulations & in PMACA] will be pursued and investigations related to violations of the WH&B PMACA.

Includes all costs of law enforcement when conducting compliance, patrol, enforcement and investigations related to violations of WH&B Private Maintenance and Care Agreement.

The issuance of title is included in this program element.

NX Inspect Commercial SRPs for Compliance

Special Recreation Permits Compliance includes all activity associated with managing, directing, and evaluating the authorization of SRPs for commercial, (including vending), organized group activities and events, and competitive events. Work includes general pre- and post-event/activity management, monitoring, evaluation, compliance, and enforcement of the conditions of the permit and any special stipulations. Work also includes processing annual fees, annual use reports, insurance renewal, and evaluations. Also includes all procurement and labor expense associated with the management of SRPs for commercial use, (including vending), organized group activities and events, and competitive events, as described in the 1999 SRP training syllabus for course No. 8300-14. Includes renewal of permits issued in previous fiscal years. The new regulations, 43CFR 2930, will incorporate the same definitions when the new SRP regulations are finalized. All law enforcement duties including patrol, enforcement, and/or investigative activities related to Commercial SRPs program should be charged to this program element. This includes all labor and operational dollars to deter, detect, investigate or prosecute violations of rules, regulations or laws pertaining to this program. This also includes work performed by law enforcement officers to protect volunteers, employees or government property associated with this program.

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Monitoring Project Elements for Effectiveness

DJ Evaluate Land Use Plans

Land use plans evaluated to determine if land use plans (MFPs and RMPs) are current and address new information and circumstances, court decisions, statutory requirements, current management strategies, and policy requirements. Include all costs associated with evaluating land use plans, including costs to determine if new decisions are needed, impact assessments are valid, mitigation measures are being implemented, new information is available which would affect plan decisions or analysis, or if program or policy requirements are adequately addressed in land use plans (e.g. comprehensive land health standards), etc. [Note: The results of resource assessments and monitoring may be used in completing evaluations, but resource assessment and monitoring costs should not be charged to this element.]

MA Evaluate Recreation Areas

Recreation site/area objectives evaluated for Special and Extensive Recreation Management Areas, Recreation sites including fee sites, ACECs (including Natural Areas), caves, Natural and National Historic Landmarks, National Recreation Areas, and Watchable Wildlife Areas or Off Highway Vehicle use. Work and costs includes monitoring of on-the-ground actions, evaluation as to whether the management actions taken are meeting the planning objectives, and permanent documentation of findings.

The process for this program element is as follows:

1. Schedule evaluation in AWP based on management plan or management decision.
2. Identify specific recreation objectives to be evaluated; and
3. Produce an evaluation report which documents findings.

This PE does not include the evaluation of whether the recreation program is meeting the intent of the authorizing language of a National Conservation Area or a National Monument. This evaluation should be charged to DJ. Wilderness and WSAs evaluations are charged to MD. Also excludes linear recreation units, see MV.

MB Evaluate Forest/Woodland Treatments

Acres monitored and/or evaluated, including reforestation and forest development surveys associated with the Forest and Woodland Management Treatments program element (HD) and the Forest and Woodland Restoration Treatments program element (JE). Program element MB includes implementation monitoring (determining if forest management treatments were carried out as designed), effectiveness monitoring (determining if prescribed treatments achieve desired objectives), and/or validation monitoring (determining if data, requirements, and assumptions are correct or if better ways are needed to meet objectives). Evaluation in program element MB includes Plus tree site and forest regeneration/reforestation stocking surveys.

Appropriate charges include actual monitoring and evaluation, and all costs associated with evaluation, analysis and reporting of the results of Forest/Woodland treatments. Do not include timber sale administration costs. Overhead and support costs may be coded to this program element, but they must not be coded to sub activity 5900 (See Instruction Memorandum No. 98-87).

MF Evaluate Designated Rivers and Trails

Includes all operations and labor costs associated with the determination of whether management objectives and decisions related to nationally designated Wild and Scenic Rivers, and Trails are being achieved. Work includes all monitoring and evaluation of the data to make the determinations. Work can be reported in the absence of an activity plan if the monitoring is done pursuant to a land use decision or some other form of documented decision.

MK Evaluate Weed Treatments

Evaluation of the number of acres treated to determine effectiveness.

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All appropriate labor and operational costs associated with evaluation of weed treatments. This could include, but is not limited to: employee salary, travel costs, vehicle costs, purchase of equipment (such as GPS units), contract costs and map costs (GIS, base maps).

ML Monitor Grazing Allotments

Grazing Allotments Monitored includes all costs associated with allotment monitoring such as: planning for the monitoring, data gathering, labor in the field and the office, GIS support, data management support, contracts/interagency agreements and equipment purchase/lease/rental.

Allotment monitoring relates specifically to data collection which is needed to analyze the effectiveness of management practices, restoration measures or project/treatments in achieving and/or measuring movement toward land use objectives and/or rangeland health standards. It includes any form of reoccurring data collection that will assist in characterizing the allotment, such as vegetation production, utilization, use pattern mapping and actual use.

This does not include the analysis, interpretation and evaluation of the data, or determination of whether rangeland health standards are achieved (PE=MJ).

MN Monitor Lake/Wetland Habitat

Aquatic and Wetland Monitoring and Evaluation includes all labor and operating costs associated with documenting habitat condition for lake/reservoir aquatic species and wetland areas.

This work includes the collection, evaluation and reporting of information on lakes and reservoir habitat (including Special Status Species) necessary to determine if management decisions have been implemented and objectives are being met. It includes implementation, effectiveness and validation monitoring components. Habitat monitoring is typically based on species habitat parameters and is directly relevant to a species of interest. Wetland re-assessment for Proper Functioning Condition is included in this program element.

MO Monitor Stream/Riparian Habitat

All labor and operating costs associated with documenting habitat condition for stream and river aquatic species.

This work includes the collection, evaluation and reporting of information on streams and river habitat (including Special Status Species) necessary to determine if management decisions have been implemented and objectives are being met. It includes implementation, effectiveness and validation monitoring components. Monitoring is separate from information collected as part of recurring or ongoing inventory programs. Habitat monitoring is typically based on species habitat parameters and is directly relevant to a species of interest. Riparian re-assessment for Proper Functioning Condition is included in this program element.

MQ Monitor Terrestrial Habitat

All labor and operating costs associated with documenting habitat condition for plant and botanical resources.

This work includes the collection, evaluation and reporting of terrestrial wildlife and plant habitat (including Special Status Species) information necessary to determine if management decisions have been implemented and objectives are being met. It includes implementation, effectiveness and validation monitoring components. Monitoring is different from inventory in that a specific hypothesis or question is tested (e.g., was the treatment/project successful in meeting its objective?). Terrestrial and botanical/plant habitat monitoring is based on species habitat parameters that is directly relevant to a species of interest.

MR Monitor Species Populations

All labor and operating costs associated with documenting population status and trend.

This work includes the collection, evaluation and reporting of species population information (including Special Status Species) necessary to determine if management decisions are being met. Monitoring is different from inventory in that a specific hypothesis or question is tested (e.g., are population trends stable, declining or increasing?). For purposes of consistency, any site established for monitoring species

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populations will be considered a population (e.g., 180 bald eagle sites monitored is a more accurate reflection of the work, rather than reporting 1 population of bald eagles; 3 smolt traps in a basin to monitor Chinook salmon are count as 3 sites, and hence 3 populations monitored).

MX Monitor Shrub/Grass Vegetation Treatments

Includes labor and other costs associated with collecting and evaluating data to determine the effects of the treatment, whether or not objectives were achieved, and cost effectiveness. Monitoring should be funded by the activities benefiting from the treatment. Establishing plots for monitoring fire behavior, fuel moisture, and direct effects of the fire treatment, and immediate post-treatment monitoring of these plots is costed to hazardous fuels reduction (PE = JM) and is part of the hazardous fuels reduction project cost

Do not code fire rehabilitation treatments monitored to this program element, they are reported to (MZ), weed treatments evaluated (MK) or monitoring fuel management treatments (MT).

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Q: General Accounting Office and Other Reviews

Wildland Fire Rehabilitation and Restoration, Forest Service and BLM Could Benefit from Improved Information on Status on Needed Work

June 2006 GAO GAO-06-670

USFS & BLM should improve their information on whether post-fire rehabilitation needs are met. Track and report to Congress all high priority rehabilitation and restoration work needed and accomplished.

Surface Compliance of Coal Bed Natural Gas (CBNG) Development in North Central Wyoming

November 2005 Benjamin Kniola, Julian Gil Wyoming

The summary of 628 compliance/inspection monitoring reports of operators with Conditions of Approval (COA) in Powder River Basin were reviewed. Most operators were out of compliance (530 of 628) with reclamation efforts, particularly seeding and excessive weeds.

Environmental Information; Status of Federal Data Programs That Support Ecological Indicators

September 2005 GAO GAO-05-376

While BLM was not specifically addressed as part of the 20 programs reviewed across federal agencies, the findings are relevant to BLM. Specifically, continue providing nation-wide data used in nationwide ecological indicator study by Heinz Center; continue to generate data comparable with data from past years.

Response to GAO report "Environmental Information: Status of Federal Data Programs that Support Ecological Indicators"

9/21/2005 The Heinz Center GAO-05-376

GAO understates need for monitoring and reporting. Seven programs of 20 reviewed identified having insufficient resources to do necessary monitoring--not clear if BLM is one of them.

Oil and Gas Development, Increased Permitting Activity Has Lessened BLM's Ability to Meet Its Environmental Protection Responsibilities

June 2005 GAO GAO-05-418

Need to use cost recovery to augment staffing shortages to do O&G work, including the support of monitoring. OMB identified need for National Monitoring Strategy in 2003. O&G permitting has more than tripled in last six years putting additional pressure on monitoring activities. I&E are not being done and have been traded-off for permitting activities. Four of eight field offices did not have any resource monitoring plans. Backlog of reclamation reviews has also been traded off for permitting. Only six of sixteen Resource Management Plans (RMPs) had detailed plans for monitoring environmental impacts of O&G development. Staff shortages and old plans are blamed.

Law and Order in the Oil and Gas Fields; A Review of Inspection and Enforcement Programs in Five Western States

February 2005 Western Organization of Resource Councils

Inspections improvements since '98 are in production. Environmental inspections are lagging--specifically, BLM can do environmental inspections of active wells only every 4-59 years. Inspectors are not distributed according to workload.

Oil and Gas Development, Challenges to Agency Decisions and Opportunities for BLM to Standardize Data Collection

November 2004 GAO GAO-05-124

Need to standardize collection of public challenge data at the leasing stage. State Offices collect such data but use it inconsistently. Multiple independent systems are used and not integrated across the country.

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Various Reports

14 GAO report highlight pages about monitoring related findings from various land management agencies of which 8 had relevant findings, not also covered in this spreadsheet: e.g. Endangered Species, Research Strategy and Long-Term Monitoring Needed for the Mojave Desert Tortoise Recovery Program

Endangered Species, Research Strategy and Long-Term Monitoring Needed for the Mojave Desert Tortoise Recovery Program

December 2002 GAO GAO-03-023

1) FWS spent $100M on tortoise recovery, but economic impact is unknown. Monitoring done by other agencies (including BLM) can't be counted on due to other priorities; 2) USDA & DOI-Specify procedures to be used to monitor treatment effectiveness and develop an interagency system to collect, store, and disseminate monitoring results; 4) USFS & DOI told to collect detailed nationwide data to identify and prioritize which federal lands need fuels reduction; 5) DOI & OMB-develop a national geospatial strategic plan to reduce duplicative investments, 6) DOI & USDA-develop a plan to implement a monitoring framework, develop guidance that formalizes assessment of landscape-level risks to ecosystems, and clarify existing guidance working with CEQ to assess risks of environmental effects from fuel reduction; 7) DOI and USDA-collaborate with other depts. on weed management; 8) Collaboration across agencies doesn't work well to determine effectiveness of land management actions, e.g. BLM eliminating sheep grazing on 800K acres to help tortoise population hasn't been evaluated as to effectiveness by FWS;

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R: Program Assessment Rating Tool Reviews

November, 2006
FY 2008 Passback
Resource Monitoring

OMB has supported past BLM-requested funding increases for monitoring to improve baseline data and understanding of the impacts of various resource uses as well as BLM actions. A lack of understanding of resource conditions was a weakness identified in the 2004 PART on BLM's restoration programs and again in this year's Resource Management PART.

Implementation of a comprehensive monitoring plan should be an agency priority. The agency should work with OMB to identify base funds that may be consolidated to improve collection, management, reporting, dissemination, and use of monitoring data. BLM should provide to OMB a status report on its monitoring efforts by February 23, 2007.

Assessment Year 2005
FY 2007 Program Assessment Rating Tool - Land Use Planning

1.4 Is the Program Design Free of Major Flaws that would limit the program's effectiveness or efficiency?

Explanation: The Planning Program is designed to monitor, evaluate, and amend land use plan decisions in a continuous cycle to ensure that the land use plan decision framework is up-to-date. BLM state and local offices, in coordination with other BLM resource programs, are ultimately responsible for implementing approved land use plans through activity level plans and subsequent on-the-ground actions. The Planning Program is also responsible for monitoring the implementation of land use plans, while the BLM's other programs are responsible for monitoring to ensure that actions are implemented as designed and are meeting the desired results. In recognition of the importance of monitoring, BLM has established a National Monitoring Strategy which is coordinated by an interdisciplinary committee involving various BLM programs. Planning is a key partner of this committee and works to help facilitate ensuring that effectiveness monitoring is an interdisciplinary effort and those actions are leading toward meeting BLM land use plan goals\objectives.

Assessment Year 2005
FY 2007 Program Assessment Rating Tool - Land Use Planning

2.3 Does the program have a limited number of specific annual performance measures that can demonstrate progress toward achieving the program's long-term goals?

Explanation: The program has developed a measure relating to completed plans/amendments that may be used to demonstrate progress toward achieving the program goal of completing and maintaining up-to-date land use plans. However, the planning program does not have an annual measure that ties back to a long term measure related to implementation effectiveness.

Assessment Year 2005
FY 2007 Program Assessment Rating Tool - Land Use Planning

2.8 Has the program taken meaningful steps to correct its strategic planning deficiencies?

Explanation: BLM has recently recognized the need for the Planning Program to serve a greater role in coordinating the collection, reporting, and analysis of monitoring data among BLM's many programs. To this end, the agency has established a Monitoring Coordinator position within the Planning Program. This position facilitates the interdisciplinary committee that coordinates BLM's National Monitoring Strategy. Better coordination will help improve BLM's monitoring information base. Effective monitoring will help ensure that BLM leadership and managers have all of the information necessary to: 1) effectively prioritize land use planning efforts across geographic areas, 2) evaluate the effectiveness of completed plans, and 3) establish more meaningful resource protection goals and track progress toward those goals over time. However, BLM still needs to develop additional annual and long term outcome measures for the program. DOI will work with OMB to identify additional long-term and annual measures to better gauge the performance of the program in the future.

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December, 2005
FY 2007 Passback
Land Use Plan Monitoring:

OMB has supported past BLM-requested funding increases for monitoring to improve baseline data and understanding of the impacts of various resource uses as well as BLM actions. This included funding within BLM's land use planning budget as well as funding specific to the Departmental hazardous fuels reduction program. A lack of understanding of resource conditions was a weakness identified in the 2004 PART on BLM's restoration programs.

Although some progress has been made, BLM has yet to present a clear plan for how it would conduct this monitoring. BLM needs to make development of a comprehensive plan for prioritizing monitoring needs an agency priority. The agency should work with OMB to identify base funds that may be consolidated to improve collection, management, reporting, dissemination, and use of monitoring data. BLM should provide a status report to OMB by January 9, 2006 with a detailed plan describing: 1) the type and extent of monitoring data that local land units are to collect and methods for collecting these data, and 2) how the agencies will collect, store, analyze, and disseminate information on monitoring results for use in management decisions. In particular, OMB is interested in land health data that can be "rolled up" to the national level and in the amount and quality of information that is accessible to the public through BLM's website. (December 2005)

November, 2004
FY 2006 Passback

Monitoring is another component in evaluating fuels treatment effectiveness. OMB supported funding for increased monitoring within the fuels program ($8 million in the FY 2005 budget), but DOI has yet to adequately explain what exactly this funding would accomplish. To ensure that monitoring funds are effectively spent, DOI should report to OMB by March 1st, 2005 on 1) the type and extent of monitoring data that local land units are to collect and methods for collecting these data, and 2) how the agent will collect, store, analyze, and disseminate formation on monitoring results for use in management decisions.

November, 2003
FY 2005 Passback

$3 million of Land Use Plan Monitoring across BLM's programs to improve baseline data and understanding of the impacts of various resource uses as well as BLM actions. An additional $1 million should be redirected from land use plan development to provide a total of $4m for this project. A lack of understanding of resource conditions was a weakness identified in the 2004 PART on BLM's restoration programs.

While OMB supports additional emphasis on monitoring, we are concerned that, as with the hazardous fules program, BLM should develop a comprehensive plan for prioritizing monitoring needs and should work with OMB to identify base funds that may be consolidated to improve management, reporting, dissemination, and use of monitoring data. BLM should report to OMB by January 9, 2004 with an initial plan describing: 1) the type and extent of monitoring data that local land units are to collect and methods for collecting these data, and 2) how the agencies will collect, store, analyze, and disseminate information on monitoring results for use in management decisions. OMB expects that this information will be used to justify the funding increase in BLM's FY 2004 Congressional Justifications. DOI should then work with OMB to develop a more detailed final report by March 1, 2004

However, OMB remains concerned that WUI funds are not being used effectively as possible, a view supported by a GAO review as recently as August. OMB supports the DOI proposal to increase monitoring within the fuels program, but believes that this is a basic management component that should have been funded adequately from the outset of the program. As such, only $1.7m in additional funds is provided, but Passback assumes that DOI will set aside a minimum of $5m within the program in FY 2005 to support program monitoring work. DOI has not yet presented a clear plan for how it would begin this monitoring. To ensure that monitoring funds are effectively spent, DOI and

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USDA should report to OMB by January 16, 2004 on 1) the type and extent of monitoring data that local land units are to collect and methods for collecting these data, and 2) how the agencies will collect, store, analyze, and disseminate information on monitoring results for use in management decisions.

December, 2002
FY 2004 Passback

$1.9m for improved monitoring of resource conditions across BLM's programs to improve baseline data and understanding of the impacts of various resource uses as well as BLM actions. A lack of understanding of resource conditions was a weakness identified in the recently completed PART on BLM's restoration programs. OMB encourages BLM to develop a comprehensive plan for prioritizing monitoring needs and to consider additional reallocation of base funding to meet these needs.

December, 2002
FY 2004 PART - Resource Protection

Findings were used to justify budget increase that funded the AIM Strategy. However some weaknesses were identified in the assessment. These include:
1. Gaps in monitoring of resource conditions to support management decisions and to assess the impacts of restoration activities.
2. A lack of program performance measures that focus on efficiency.
3. Insufficient data on existing performance measures to ensure that baseline data is accurate and performance targets are aggressive.
4. Significant similarities and potential overlaps between activities conducted in BLM's restoration programs and in the Department's wildland fire management program for rehabilitation and fuels reduction.

Based on these findings, the Administration will:
1. Provide an additional $2 million in 2004 for BLM monitoring activities to improve baseline data and track trends over time.
2. Refine existing performance measures and develop consistent efficiency measures across the Department for similar restoration activities.
3. Evaluate options for more clearly distinguishing between restoration activities funded with the Department's wildland
fire program and BLM's operating programs.

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S: Internal Program Reviews

Pinedale Field Office; Commitments Made in Decision Documents not yet Archived- Opportunities for Improvement

May 2006 Wyoming

This evaluation found that ROD commitments are not always being completed. Five hundred and eighty commitments were made in the RODs for the Pinedale Planning Area (Jonah Field & Pinedale Anticline). BLM was supposed to track NOX to watch for a threshold of 977 tons/year above 1998 levels. If exceeded, BLM to contact other agencies due to adverse impact to air quality. Total NOX emissions were supposed to be kept at 693.5 tons/yr. No NOX tracking has been done from early 2000s to date of report. Levels were exceeded. Numerous other commitments were not completed.

Range Program Evaluation

2006 Colorado

T&E species biological assessments were delayed. LHA interdisciplinary teams don't include fire and aren't truly integrated. Insufficient funding to do follow-up monitoring when management adjustments are made.

Soil, Water and Air Action Plan

2006-2008 BLM

Half of the 03-08 Operations Plans goals that require SWA input are behind schedule. SWA AIM workload is increasing, budget is decreasing, and staff age is 31%>27 years. There are imbalances in where staff are located with particular shortages in NM, AZ, & CA.

Invasive and Noxious Weed Program Alternative Internal Control Review Report

2006 California

Many large areas still to inventory. GIS IS BEING USED. Follow-up monitoring on weed stipulations is not being completed due to lack of staff. While monitoring is being done, documentation of monitoring is not being done.

Oil and Gas Surface Management Self-Assessment

2005-2006 BLM

Cobell related shutdowns of Automated Fluid Mineral Support Services (AFMSS) are affecting recording of APDs and inspections.

Oil and Gas Quality Assurance Team (QAT) Review of APD Processing in the Price Field Office

9/30/2005 Utah

Applications for Permit to Drill (APD) had insufficient documentation of well reviews by specialists. There was insufficient management interest in timeliness and quality of Application for Permit to Drill. Seven, thirty, and forty-five day regulatory letters not being used to control operators.

Range Program Evaluation

5/9-13/2005 Montana

There was concern about staffing and funding to complete workload. GIS data management is inadequate in Miles City Field Office. There was not enough monitoring being done and too much reliance on indicators.

Range Technical Program Review (TPR)

4/4-8/2005 Idaho

There is a shortage of -ologists to do work. Insufficient skills for some team members. Not enough monitoring, too much reliance on indicators. Litigation has forced misplaced monitoring priorities, making watersheds too low of a priority. LHA interdisciplinary teams don't include fire and aren't truly integrated.

Range Program Evaluation

4/18-22/2005 Nevada

There is a shortage of -ologists to do monitoring. Offices are using allotments and not watersheds as basis for monitoring. Offices are using multi-disciplinary rather than interdisciplinary approach. The monitoring work is behind schedule. There is a lot of litigation and staff perception there is insufficient data to be defensible.

Idaho Falls District; General Management Evaluation Report
8/22-26/2005 Idaho
Each FO has a different EA policy. DO should establish a policy for all offices.

Soil, Water Air & Riparian Program Evaluation
2005 California
36% of Riparian treatments in the office involved a monitoring plan. Water quality management plans to align with state agreements are missing for a number of States. Some grazing permit decisions are being held up pending completion of AIM work or policy saying LHAs will work. Some available AML funding is not applied for. Data are differently stored and managed across FOs. Plans often don't connect impaired water impacts in alternatives in plans, making the plans less defensible. Insufficient budget to do the work plans, EISs, &EAs. Reporting of accomplishments completed through low-cost partnering are not reported because they reduce budget competitiveness within FOs (finding 18, pg 20). SWA manuals are out of date or non-existent-need better guidance. While only 17% of SWA staff have attended a recent PFC assessment course, most understood PFC.

Soil, Water, Air & Riparian Tech. Program Review Report
2/16/2006 California
Ditto-slightly different version of report above

Fluid Minerals, APD/Best Management Practices; Quality Assurance Team - Vernal Field Off.
2004-2005 Utah
Contractors are conducting Environmental Assessments.

Range Program Evaluation
9/20-24/2004 New Mexico
Shortage of -ologists to do Land Health Assessments (LHA); 4 offices had inadequate monitoring equipment. Two districts have inadequate monitoring data. VMAP resources are scarce and contract labor from local universities for data entry should be used.

Range Program Evaluation
6/26-30/2004 Wyoming
No findings

Range Program Evaluation
4/26-30/2004 Utah
Concern about losing staff to retirement before completing '09 permits

Invasive and Noxious Weed Program Management Control Review Report
2004 Nevada
There are many large areas still to inventory. Not using GIS for inventory. While monitoring is being done, documentation of monitoring is not being done.

Mining Law Administration, Surface Management Program & IB
FY 2004 BLM
Deficiencies in surface management are tied to funding and staffing shortages. The 3809 Regulation has increased the surface management workload. Manuals and handbooks are needed for 3809. Inspection and Enforcement work was found to have several deficiencies.

Fish, Wildlife, Botany, and Special Status Species Program Evaluation: Final Report on Evaluation Findings and Recommendations for Action Plan Development

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3/31/2003 **BLM**
"The lack of a coordinated, national program for inventory of FWBSSS resources on BLM-managed land is problematic, because it is difficult to manage resources without knowledge of their status on public lands." Inventories by previous employees are lost to new employees. Only 32-39% of offices have a regular program of scheduled inventory for habitat. 38% said they had a formal monitoring program, but only 32% said monitoring program was integrated with others. Only 50% use BLM corporate data standards. 47% said data is in electronic database, 40% said in GIS.

A Report to Congress on the Status of the BLM's Monitoring and Assessment of Resource Conditions

4/22/2003 **BLM**
This report to Congress in 2003 detailed the status of monitoring, monitoring capabilities and resources, and recommendations. Cumulative $26 million provided in 2001 and 2002 to update plans (making planning budget about $48M), bringing more focus on monitoring. $90 M was spent in 2002 out of base resources on monitoring. FINDING: most monitoring evaluates compliance with use authorization decisions such as O&G I&E. In 2004, BLM asked for an additional $1.9 M for broad-scale land health monitoring, as well as an additional $2M for I&E for O&G. Estimates of funding increases for monitoring based on land use plan requirements is expected to increase 10% per year over next 5 years. Comb Wash and Price Road cases are cited. Baseline inventories on a large scale are inadequate. 2002 budget focuses monitoring on high-priority areas. Effectiveness monitoring required by land use plans is often deferred due to other priorities, and even if not deferred, BLM has insufficient resources to complete it.

Annual Report; Systems, Controls, and Legal Compliance: Managerial, Administrative, and Financial Controls

2000 **BLM**
No findings.

Rangeland Monitoring Alternative Management Control Review

9/6/1996 **BLM**
The 1996 review validated that the findings of the 1992 GAO report regarding rangeland monitoring shortfalls still existed. A 50% increase in staffing and funding was identified as needed to do the work. Not all high priority allotments are being monitored consistently. As a result, many grazing decisions are being delayed because of a lack of quality monitoring data, and many grazing decisions that are issued are not adequately documented with monitoring data.

Program Evaluation Report- National Environmental Policy Act Evaluation

3/19-23/1990 **California**
Report is very dated. Susanville DO: Cumulative impact analysis documents need to be improved. More emphasis needed on monitoring.

Alternative Internal Control Review (AICR) of Soil Inventory Component of Soil, Water, and Air Resources Program

6/16/1990 **Wyoming, Nevada, New Mexico**
This review is quite dated. There are no standard procedures that documents the rationale used in selecting the most efficient organizational unit to carry out individual soil mapping projects. It is difficult to clearly determine whether the soil inventory projects are more cost efficient using BLM staff, SCS staff or private contractor services.

Technical Procedures Review: Alternative Internal Control Review of the Range Improvement (RI) Program

5/15-16/1989 **BLM**
While this report is very dated, the trend was that range improvements were often completed without a plan, without regard to long range impact, and range improvements were not monitored for effectiveness. Personnel shortages were sited as the main reason for no monitoring.

Program Evaluation Report- Surface Protection

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5/13-22/1985 Arizona

Surface compliance not seen as a high priority. Lack of interdisciplinary focus on surface protection. Little communication of surface protection data and issues across offices. EAs documentation is inadequate. Monitoring the effectiveness of mitigating measures is a low priority in many offices.

Oil and Gas I&E Management Control Review (Email Comments)
6/24/1994 New Mexico, Colorado, Wyoming

This report is ancient. I wonder if the findings are still valid. They may help establish a trend however. The key findings were lack of staff to conduct the Inspection and Enforcement work.

Technical Procedures Review of the Nevada Mining Law Surface Management Program
6/29/1992 Nevada

This report is very dated. FINDINGS: inability to meet mandatory I&E requirements and failure to achieve reclamation of abandoned sites. Most deficiencies were due in part to lack of personnel. While procedures were being followed, quality and quantity of analysis and follow-up were insufficient. Undue degradation and threats to human and animal life occurred, with abandoned cyanide heaps...

Self-Assessment notes from a spreadsheet of Jenna's, but I can't figure out what report or date this was.
California

One office (Ridgecrest) had an interdisciplinary monitoring strategy in place. All interviewees agree that the ID approach is the most desired way to capitalize on efficiency and quality of data in monitoring efforts. Resource objectives usually are not clearly quantified, making it impossible to determine whether or not they have been met at some future date. No office has the staff or time to conduct adequate resource monitoring. Field offices in the Desert District are doing the best job of all in implementing interdisciplinary monitoring for ecosystem management. However, most offices do not have good monitoring plans. All offices have the 1980's version of the range monitoring plan. These plans have not been implemented due to lack of personnel and other priority work. Field office personnel are concerned about the lack of monitoring currently occurring.

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T: Other Natural Resource Agency's Strategies for Monitoring and Reporting

Partnership Opportunities in Developing the National Monitoring Strategy

USGS

USGS Status and Trends program
The mission of the Status and Trends Program is to measure, predict, assess, and report status and trends of the Nation's biological resources to facilitate research, enable resource management, and promote public appreciation.
National Monitoring Strategy—The USGS Status and Trends program is developing a National Monitoring Framework that facilitates the integration of information from a variety of sources, at multiple spatial and temporal scales, to describe and track the health of the Nation's ecosystems. The National Monitoring Framework will develop and evaluate inventory and monitoring methods, and analytic tools and technologies to measure biological status and trends. USGS will achieve national-level assessment by collecting, managing, archiving, and sharing critical monitoring data in cooperation with partners. The National Monitoring Framework will produce and provide analyses and reports that synthesize information on the national status and trends of U.S. flora, fauna, and ecosystems.
Biomonitoring of Environmental Status and Trends—The Biomonitoring of Environmental Status and Trends (BEST) Project is a component of Status and Trends Program. The BEST Project monitors select species and habitats for indications of environmental contaminants, develops operational biomonitoring methods and tools, and synthesizes contaminant-effects information to natural resource managers, other Federal and State agencies, and the public.

Integrated Landscape Monitoring Program
The Integrated Landscape Monitoring (ILM) program aims to provide landscape-scale, integrated scientific information and monitoring tools to understand land condition and trends. These tools will aid in assessing and predicting impacts of landscape change and evaluating management action to better inform decision-makers. The ILM program is being piloted in four areas: the Great Basin, Puget Sound, Prairie Potholes, and Mississippi Alluvial Valley. The key ILM steps include 1) development of conceptual models that describe ecological and anthropogenic processes, 2) identification and prioritization of ecosystem drivers and stressors, 3) development of relevant management and monitoring questions, and 4) data mining and analysis. The end product for each pilot will be an interdisciplinary monitoring strategy that will effectively track landscape changes and inform adaptive management strategies.

National Biological Information Infrastructure
The National Biological Information Infrastructure (NBII) is a data management system that provides increased access to data and information on the nation's biological resources. The NBII links diverse, high-quality biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry.

Natural Resource Monitoring Partnership
The Natural Resource Monitoring Partnership is a collaborative effort by the natural resource management community to improve monitoring efforts in order to support effective evaluation and decision-making. The initial focus of the Natural Resources Monitoring Partnership is the development of NBII-based tools to foster coordination and collaboration of monitoring efforts. The Monitoring Protocol Library is an internet accessible, searchable database that provides information on monitoring protocols and resource assessment methodologies organized to facilitate reference and use. It will be a catalog of protocols developed and maintained by users, under the management of an archivist/librarian.
The Monitoring "Locator" is an internet-based, GIS application that allows users to identify what natural resource monitoring is being conducted within a particular area (e.g., State, county, Canadian Province, or other selected geographic area). Users of this system will have search tools to find out about ongoing and historic monitoring according to the scales, targets, and objectives that are of interest to them.

National Land Cover Dataset

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The National Land Cover Dataset is available for the conterminous United States, and was derived from the early to mid 1990s using Landsat Thematic Mapper satellite data. Currently a second-generation comprehensive land cover database for the nation is being developed. The new National Land Cover Dataset will encompass all 50 states and is planned for completion by 2006. These land cover data products are useful in supporting other land cover research projects around the United States such as the Fire Danger Monitoring and Forecasting Project.

The USGS Center for Earth Resources Observation and Science (EROS) is the national archive for remotely sensed images of the Earth's land surface, operating and managing the Landsat 5 and 7 satellite missions and works closely with the National Aeronautics and Space Administration (NASA) to define and implement future satellite missions. The USGS acquires, processes, archives, and distributes Landsat and other satellite and airborne remotely sensed data products appropriate for systematic assessment of national land use dynamics.

Geographic Analysis and Monitoring

The Geographic Analysis and Monitoring (GAM) program uses earth observation data supplied by land remote sensing coupled with data from many natural science sources and relevant socio-economic data to quantify the rates, identify key driving forces, and forecast future trends of landscape change. GAM studies are conducted within a geographic context and at a range of spatial and temporal scales in order to provide a comprehensive, interdisciplinary perspective. GAM scientists also conduct related studies about environmental and human health, wildfire, urban ecology, and natural hazards.

National Gap Analysis Program

The purpose of the Gap Analysis Program (GAP) is to provide broad geographic information on the status of ordinary species (those not threatened with extinction or naturally rare) and their habitats in order to provide land managers, planners, scientists, and policy makers with the information they need to make better-informed decisions. Vegetation is mapped from satellite imagery and other records using the National Vegetation Classification System. Native animal species ranges are mapped by using museum and agency specimen collection records in conjunction with known general ranges and the animal's affiliation with the previously mapped vegetation types and other physical characteristics. These data are combined and displayed with a computerized geographic information system (GIS) at a cartographic scale of 1:100,000. Maps of vegetation types, individual species, or selected suites of species are overlain on maps of land ownership and land management, showing where land-based conservation efforts can be focused to achieve the conservation of selected elements of biodiversity most efficiently.

National Water-Quality Assessment

The USGS implemented the National Water-Quality Assessment (NAWQA) Program in 1991 to develop long-term consistent and comparable information on streams, rivers, ground water, and aquatic systems. The NAWQA program is designed to address the condition and trends of our Nation's streams, rivers, and ground water, as well as how natural features and human activities affect these conditions. NAWQA scientists collect and interpret data about surface- and ground-water chemistry, hydrology, land use, stream habitat, and aquatic life in parts or all of nearly all 50 States using a nationally consistent study design and uniform methods of sampling analysis allowing for regional and national assessments.

National Park Service

Inventory and Monitoring (I&M) Program

The NPS Inventory and Monitoring (I&M) Program strives for a broad-based understanding of the status and trends of each park’s natural resources. The program outlines collection, organization, analysis, and synthesis of natural resource data for 270 park units in 32 I&M networks. The networks have a relatively small set of measurements for each region (vitals signs) that represent the overall health or condition of park resources. The program is also beginning to quantify change in land cover inside and outside parks using remotely sensed data sources. Unfortunately, current NPS data collection and analysis is network driven, addressing only regional, rather than both regional and national, status and trends.

The Natural Resource Database Template (NRDT) is a set of Microsoft Access relational database tables that parks and networks can use to develop applications for capturing natural resource I&M data. NRDT integrates with other I&M data management systems and data standards including the NR-GIS Metadata

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Database, Geographic Information System (GIS) tools and data, the NPS GIS Committee Data Layers Standard and the NPS Metadata Profile.

Fish and Wildlife Service

National Wetlands Inventory

The Fish and Wildlife Service established the National Wetlands Inventory to monitor and report changes in U.S. wetland acreage. The Emergency Wetlands Resources Act of 1986 directs FWS to map U.S. wetlands and deep water habitats and produce information on their characteristics, extent, and status. Remote sensing is used extensively to monitor wetland acreage changes. Color infrared photography and other imagery taken at different dates are compared and changes are recorded and subject to statistical analyses. Geographic information system (GIS) technologies and analyses identify national or regional hot spots of wetland loss without reliance on more expensive remote sensing techniques or the subjectivity of field reconnaissance.

FWS is working to improve its National Wetlands Inventory by conducting status and trend analyses at regional, State, or local scales, increasing the number of sample plots to obtain statistically rigorous findings, and decreasing its reporting intervals to a maximum of every five years.

Environmental Protection Agency

National Environmental Monitoring Initiative

The EPA is currently conducting research to evaluate options for establishing an integrated, cooperative monitoring program, with participation by federal, state, and private entities, resulting in annual statistical reports and interpretive summaries on the status and trends in the health of the nation's ecosystem on the regional and national scale.

The Environmental Monitoring and Assessment Program (EMAP) is a research program to develop the tools necessary to monitor and assess the status and trends of national ecological resources, which supports the National Environmental Monitoring Initiative of the Committee on Environment and Natural Resources (CENR). EMAP's goal is to develop the scientific understanding for translating environmental monitoring data from multiple spatial and temporal scales into assessments of current ecological condition and forecasts of future risks to our natural resources. EMAP is also investigating designs that address the acquisition, aggregation, and analysis of multi-scale and multi-tier data.

The National Environmental Monitoring Initiative is currently bringing together environmental monitoring and research organizations from across the United States. It links large-scale survey information and remote sensing with ecological process research at a network of multi-resource, intensive monitoring areas. The result will be greater understanding of what controls ecosystem health at the regional scale, where resource management decisions are made. The initiative will collect data for aquatic ecosystems, marine/coastal areas, soils, wildlife, landscape pattern, and vegetation.

EPA Water Quality Databases

Watershed Assessment, Tracking & Environmental Results (WATERS) is an integrated information system for the nation's surface waters. The system is a digital network of surface water features, known as the National Hydrography Dataset (NHD). By linking to the NHD, one Water Program database can reach another, and information can be shared across programs.

The National Assessment Database (NAD) is EPA's interactive summary of state-reported water quality assessment information; allows the user to view assessments of individual waterbodies as well as statewide assessments.

STORET (data STOrage and RETrieval system) - STORET is a national repository for water quality, biological, and physical data. This page includes an overview of the current STORET system, explains how to download STORET data from the web, has technical details for STORET users, and more.

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Forest Service

Forest Inventory and Analysis

The Forest Inventory and Analysis (FIA) Program of the U.S. Department of Agriculture (USDA) Forest Service uses statistical surveys to report on regional and national status and trend information about forest area, location, and ownership. Specifically, FIA reports 1) forest area and location, 2) the species, size, and health of trees, 3) total tree growth, mortality, and removals by harvest, 4) wood production and utilization rates by various products, and 5) forest land ownership.

The Forest Service has significantly enhanced the FIA program by changing from a periodic survey to an annual survey and by expanding data collection to include soil, under story vegetation, tree crown conditions, coarse woody debris, and lichen community composition on a sub sample of our plots. FIA conducts annual inventories for all ownerships in each state across the country using a national standard sampling design. The FIA sampling procedure consists of three phases: 1) remote sensing classification into forest and non-forest areas and determination of fragmentation, urbanization, and distance variable, 2) a set of field sampling locations, one sample every 5,000 meters, and 3) sub-sets of the sampling locations, where a suite of vegetation and soil data are collected. The goal is to measure about 20% of the plots in the eastern half of the country and 10% of the plots in the western half of the country, in each state each year, and to make the data available annually.

National Resource Conservation Service

National Resources Inventory

The National Resources Inventory (NRI) is a statistical survey of natural resource conditions and trends on non-Federal land including privately owned lands, tribal and trust lands, and lands controlled by State and local governments. The NRI provides annual information on types and classes of wetlands, regional distributions, and associated factors like soils and land use, which are suitable for national and many regional level analyses. The underlying sampling protocol is a point-line transect of percentage ground cover.

The NRCS also is engaged in an effort to quantify the environmental benefits of agricultural conservation practices supported by USDA programs. This Conservation Effects Assessment Project (CEAP) is comprised of several components, including a National Assessment that contains the Cropland, Wetlands, Wildlife, and Grazing Lands Components, and a series of Watershed Assessment studies that complement the National Assessment components through focused investigations conducted in select watersheds around the country.

Interagency

Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is an interagency, standardized tool for determining the degree of departure from reference condition vegetation, fuels, and disturbance regimes. The Fire Regime Condition Class (FRCC) Standard Landscape Worksheet Method and Mapping Method provide tools for fire, vegetation, and fuels assessment and management at both the landscape and stand levels. Estimates of these characteristics are calculated for comparison with estimates of natural fire regime reference values and reference condition vegetation-fuel characteristics to index Fire Regime Condition Class (a classification of the amount current conditions have departed from those of historical reference conditions).

LANDFIRE

LANDFIRE, the Landscape Fire and Resource Management Planning Tools Project, is a five-year, multi-partner project producing consistent and comprehensive maps and data describing vegetation, wildland fuel, and fire regimes across the United States. It is a shared project between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior. LANDFIRE data products include layers of vegetation composition and structure, surface and canopy fuel characteristics, historical fire regimes, and ecosystem status. LANDFIRE data products are designed to facilitate national- and regional-level strategic planning and reporting of wildland fire management activities. The project has four components: the LANDFIRE Prototype, LANDFIRE Rapid Assessment, LANDFIRE National, and Training/Technology Transfer. LANDFIRE National is mapping the entire United States on an incremental basis, and maps for the entire nation will be completed in 2009.

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Collaboration on Indicators of the Nation's Environment
The Key National Indicators Initiative (KNII) was initiated at a forum convened by the U.S. General Accounting Office and The National Academies in February of 2003 to discuss whether and how a system of national indicators might be developed for three major domains: social, economic, and environmental. Ted Heintz of the Council on Environmental Quality leads the Collaboration on Indicators of the Nation's Environment (CINE), which is directed toward structuring the institutional arrangements and commitments necessary to ensure long-term production of indicators and statistical data on the nation's environment and natural resources.

Department of Defense

Ecosystem Characterization and Monitoring Initiative
The Army Corps of Engineers leads the Strategic Environmental Research and Development Program (SERDP), creating the Ecosystem Characterization and Monitoring initiative (ECMI). The ECMI is developing an ecological baseline monitoring program (one or more sites on DoD facilities for a long-term ecological data set that over time will allow the assessment of the relationships between land use, land management, and ecosystem sustainability). The first site for SEMP research and ECMI implementation is Fort Benning, Georgia.

Ecosystem study boundaries have been established on a watershed basis in coordination with installation land managers and SEMP researchers. Experimental and reference watersheds selected for inclusion in the ECMI represent a range of military and nonmilitary land use, soil type, access, size and potential for off-base influences. Data acquisition relies on remote sensing, image processing and GIS technologies, automated data recorders, remote data download, and selected field data collection. Monitoring focuses on terrestrial and aquatic productivity, aquatic decomposition, land cover type and pattern, vegetation density, weather, surface hydrology, and soil erosion/deposition. Data sets will be made available to research and land management staffs through web-based data repository.

Land Condition Trend Analysis
The Land Condition Trend Analysis (LCTA) program is the US Army's standard for land inventory and monitoring, employing standardized methods of natural resources data collection, analyses, and reporting to provide officials at all levels with standardized natural resources inventory information. The LCTA program inventories conditions and monitors changes of natural resources, implements a standardized data collection, analysis, and reporting method that enables data compilation at an Army-wide level, and evaluates land capability to meet multiple use demands.

Data collected with LCTA include topographic features, soil characteristics, botanical composition, vegetative cover, wildlife species, and surface disturbance. These data are collected from permanent plots whose locations are determined by a computer-based algorithm that uses a stratified-random design based on soils and land cover information derived from satellite imagery. The plot data can be used to estimate soil erosion, describe plant communities, estimate ground cover and disturbance, evaluate tactical concealment, and monitor land restoration projects. It can also be used to assess wildlife and endangered species habitat, determine forage condition, and verify data for input to geographic information systems (GISs).

LCTA is also an Information Management System (IMS). LCTA IMS is a series of Army-developed executable programs and data storage schemes, that provide automated programs to collect, analyze, interpret, and report natural resources data and land use impacts.

The Heinz Center

The State of the Nation's Ecosystems
The State of the Nation's Ecosystems is a collaborative, periodic report on the condition and use of the nation's ecosystems. It reports broad national and regional trends in the condition of the nation's ecosystems: coasts and oceans, farmlands, forests, fresh waters, grasslands and shrublands, urban and suburban areas, and the nation as a whole. Conditions are tracked using ~100 indicators, covering the extent of ecosystems, their chemical and physical conditions, the condition of their plants, animals, and ecological communities, and the goods and services they provide to people.

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Measured indicators answer coarse-scale questions such as “how much…” and “what is the area of…,” to assess change in the “amount” of wide-ranging variables, such as wetlands, grazed versus non-grazed grasslands, oil and gas leases, concrete, wildland-urban interface, etc. The first edition of the series was published in 2002, and future editions will be produced every five years, with the next edition due in 2007. Web updates are released in the interim.

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